SOIL SURVEY
and
RANGE SITE AND CONDITION INVENTORY

WUPATKI NATIONAL MONUMENT
ARIZONA

A Special Report

January 1971

Prepared by

U. S. Department of Agriculture, Soil Conservation Service

for

U. S. Department of the Interior, National Park Service

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INTRODUCTION

This Special Report and survey has been made under a cooperative agreement between the Soil Conservation Service, USDA, and the National Park Service, USDI, for use in the general management and planning for future development of the Monument. It is essentially a basic Soil Survey and a Range Site and Condition Inventory.

The report contains information that can be used for the use and management of the lands in the Monument. A number of interpretations can be made that will be helpful in the selection of sites for roads, buildings or other structures, recreation sites and for the management of the natural vegetation. Assistance may be requested from the local office of the Soil Conservation Service office if and when desired.

Both the soil surveys and range inventories were made by close inspection, involving many pits in the soil and much examination of vegetation, of all parts of the area. Areas in which the soils were found to be very similar in profile, a sequence of soil layers, textures and topography are delineated on the maps in the back of this report. Soil symbols such as 2A, 3J, etc. were assigned to each delineated body. The soils in the delineated area having the same symbol are very similar within a narrow range of characteristics. The same is true for the vegetation in the delineated range sites having the same symbol. Condition of the vegetation in each delineated area is also shown on the map.

In some instances two or more soils were so intermingled or in bodies of such small size that they could not be separated on the soil map. These areas, although designated by single symbols are described as complexes of the soils described. In several cases the members of the complexes were delineated as separate bodies where they were large enough. In a few instances some of the soils were so intermixed that they could not be delineated separately. Since vegetation is strongly influenced by soils, many of these complex units resulted in complexes of range sites as well.

The soils found on the Monument have been given descriptive names. The profile descriptions however, are of standard quality and will permit the classification of these soils into the National System of soil classification after more mapping has been completed in the surrounding area.

Since it is a Special Report issued to expedite the availability of the information, it has not been through all steps of the normally rigorous editing process and may contain minor discrepancies or apparent contradictions. We trust that these are few in number and of minor consequence.

Descriptions for the Soil Units and the Range Site and Condition Inventory are contained in the following sections.

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SOIL SURVEY
WUPATKI NATIONAL MONUMENT, ARIZONA
Rudolph G. Schurig, Soil Scientist
January 1971

The Wupatki National Monument lies about 30 miles north of Flagstaff, Arizona on U. S. Highway 89. It extends eastward toward the Little Colorado River and encompasses an area of approximately 36,000 acres. The Coconino National Forest borders it on the south, the Navajo Indian Reservation on the east and private or state-owned lands lie to the north and west. Cameron is 20 miles to the north. Sunset Crater, another National Monument, is 16 miles to the south.

The area within which the Wupatki National Monument lies is in the Grand Canyon section of the Colorado Plateaus physiographic province. It is an area of high plateaus, mesas, plains, breaks, canyons, and valleys. Elevations on the Monument range from 5720 feet in the southwest corner of the Monument near Highway U. S. 89 to 4280 feet on the Little Colorado River on the northeast corner. Gently sloping to steep plains on basalt bedrock are found in the west end of the Monument west of Citadel Ruin. The central part of the Monument from Citadel Ruin eastward to Doney Cliffs are on almost level plains on limestones of the Kaibab formation. Below Doney Cliffs are the eroded and broken areas of shales and sandstones of the Moenkopie formation. Drainage is east and northeastward to the northward flowing Little Colorado River.

Soils in the basalt areas are on gently sloping to steep slopes and are shallow to moderately deep. Basalt rock outcrops are common on the steep slopes and as cliffs. Cinders blown from nearby volcanic cones and drifted by the wind have formed a thin mulch over much of the area of the Monument. Locally, wind action has formed drifts more than one foot thick. The limestone areas have shallow and very shallow soils over bedrock. The sandstone and shale areas are quite complex in slope, usually have thin soils and are influenced by cinders in many places.

Data on climate for the area is very sparse. Based on limited data from Monument headquarters and a consideration of the vegetation and elevations it is estimated that the annual precipitation for the area ranges from slightly more than 6 inches in the lower elevations to possibly as high as 15 inches in the higher elevations. Part of this comes as snow, and snowfall has been recorded in all months except June and July. Precipitation in a single 24 hour period has reached 1.25 inches but most storms are much less intense. The average number of days of recorded rainfall in excess of .01 inch is about 40 at the Monument station. Some rainfall has occurred in every month, but generally more than 50 percent of precipitation is in late July to September. Temperature records are equally sparse. With a mean annual temperature of 57.3° recorded for Wupatki, it is reasonable to assume a mean annual range of 50 to 60° F. for the west to east extent of the Monument. Frost-free days (32° F. or more) are within the range of 160 to 217 days.

Subzero temperatures can be expected to occur rather frequently during the winter months at the higher elevations and occasionally at the lower

elevations. Maximum temperatures of 90 to 105° F. can be expected during the summer months.

Vegetation includes many types of annual and perennial grass and forbs, as well as shrubs and juniper trees. Grasses dominate on the basalt areas. The limestone areas are grassy with junipers invading. Shrubs and forbs are dominant in the sandstone and shale areas but there are also some grassy areas. Some of the shale areas are almost barren.

Present use of much of the Monument is range, wildlife, and watershed.

Wildlife species on the Monument are limited in number. However, antelope and rabbits were noted often during the survey and some coyotes were seen.

Early peoples used this area for dry farming by using the cinder mulches as a means to preserve moisture. At the present time part of the area is grazed by cattle. Some grassland areas seem well adapted to this use. The areas on Moenkopi shale seem to be the least adapted. The ruins of past Indian civilizations present challenge for archeological studies yet to be made. Some of the larger and more accessible ruins are open to tourists.

SOILS ON THE WUPATKI MONUMENT

For easy reference the soil units found on the Monument were grouped by parent material and given short descriptive names. By reference to the soil maps and soil legends in the back of this report one can find the symbol representing the soil or soils in the area in which one is interested. A description of the soil unit represented by the symbol is in the following descriptions.

1A - Gravelly loam, moderately deep over basalt, 0 to 5 percent slopes

This unit consists of well-drained soils over cobbly and stony basalt substrata. They are formed from basalt and cinders on nearly level to gently sloping fans and plains on basalt-capped mesas. Elevations range from 5200 to 5700 feet. Vegetation is composed of 60 to 90 percent cover of galleta, black grama, needleandthread, alkali sacaton, Indian ricegrass, threeawn, spike dropseed, and blue gramagrasses, mormon-tea, rabbitbrush, and traces of zinnia, globemallow, paperdaisy, cactus, and Russianthistle. Some areas also have a few oneseed juniper.

Typically, the surface layer is a dark grayish brown gravelly or cindery sandy loam about 8 inches thick. The second horizon is a brown gravelly loam about 7 inches thick. The underlying material is yellowish brown very gravelly loam to about 24 inches or more. The soil is slightly effervescent in the surface to violently effervescent in the substrata. Lime is concentrated as soft masses and filaments, coating on gravels, cobbles and stones, and as soft cementation.

The soil is moderately permeable. Effective rooting depth is 24 to 36 inches. These soils are used for grazing or range, wildlife, watershed, and park areas.

Representative profile: SW part of NW¼, Section 31, T25N, R10E, on top of mesa overlooking Monument headquarters, Wupatki National Monument, Coconino County, Arizona.

A11 0-1" (0-3 cm) -- Gray (10YR 5/1) very gravelly sandy loam, very dark gray (10YR 3/1) moist; weak coarse platy structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful very fine and fine roots; common very fine to medium black (N2/) cinder gravel, few angular basalt cobbles; slightly effervescent; moderately alkaline (pH 8.1); abrupt smooth boundary.

A12 1-8" (3-20 cm) -- Gray (10YR 6/1) gravelly sandy loam, dark gray brown (10YR 4/2) moist; massive; soft when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; common very fine and fine interstitial pores; 25 to 30 percent fine and medium black (N2/) cinder gravel, few angular black (N2/) basalt cobbles, strongly effervescent; moderately alkaline (pH 8.2 TB); clear smooth boundary.

C1 8-15" (20-38 cm) -- Pale brown (10YR 6/3) gravelly loam, brown (10YR 5/3) moist; massive, slightly hard when dry, friable when moist, slightly sticky and plastic when wet; plentiful very fine and fine roots; common very fine and fine interstitial and tubular pores; 20 to 25 percent fine and medium black cinder gravel and few black (N2/) rounded basalt cobbles; violently effervescent; common fine white filaments and soft masses of lime and lime coatings on coarse fragments; moderately alkaline (pH 8.3 TB); clear wavy boundary.

C2ca 15-24" (38-61 cm) -- White (10YR 8/2) very gravelly loam, pale brown (10YR 6/3) moist; massive; hard when dry, friable when moist, sticky and plastic when wet; common very fine and fine and few medium and coarse roots; common very fine and fine interstitial, few very fine and fine tubular pores; 35 to 40 percent fine and medium black (N2/) cinder gravel and rounded basalt cobbles; violently effervescent; large soft white (10YR 8/1) lime masses and coatings on gravels and cobbles; moderately alkaline (pH 8.4 TB); clear wavy boundary.

C3ca 24-30" (61-76 cm) -- White (10YR 8/1) very cobbly and stony loam, light gray (10YR 7/2) moist; massive; hard when dry, friable when moist, sticky and plastic when wet; few fine and medium roots; few very fine and fine interstitial and few fine tubular pores; 60 to 70 percent black (N2/) basalt cobbles and stones; violently effervescent; white (10YR 8/1) soft lime masses between cobbles and stones; lime coatings on cobbles and stones, moderately alkaline (pH 8.4 TB).

Variations: Depth to the C3ca horizon ranges between 20 and 40 inches. Hues of the surface layers range through 10YR and 7.5YR, values are 5 to 6 dry, and 3 to 4 moist, chromas range from 1 to 4. Textures of the surface soils are gravelly sandy loam, very gravelly sandy loam, and cobbly sandy loam. Values of the underlying horizons are 6 to 8 dry, 3 to 7 moist; chromas range from 1 to 4. Textures of the underlying horizons are

gravelly loam, very gravelly loam, loam, and light clay loam. Structure is massive or weak coarse subangular blocky.

The soil bodies range from small to very large depending on size of mesas and plains. Most of the acreage occurs on the mesa above Headquarters and on the plains and mesas in the western part of the Monument. Included in the mapping unit are small areas of 1B, Stony loam, shallow on basalt--5 to 15 percent slopes.

1B - Stony loam, shallow over basalt, 5 to 15 percent slopes

This unit consists of well-drained soils over basalt flows. They are formed in place from basalt, cinders, and limestone on gently rolling to strongly sloping mesas and plains. Slopes are 5 to 15 percent normally but may include steeper areas. Elevation is 5200 to 5500 feet. Vegetation is composed of about 70 to 85 percent cover consisting of black grama, galleta, threeawn, bush muhly, needleandthread, Indian ricegrass, rabbitbrush, mormon-tea, chamiza, juniper, woolly groundsel, scarlet globemallow, paperdaisy, spike dropseed, Russianthistle, and broom snakeweed.

Typically, the surface layer is dark grayish brown to dark brown gravelly or stony loam about 3 inches thick. The subsoil is a dark brown to dark yellowish brown loam or gravelly loam about 3 to 6 inches thick. The substratum is a grayish brown to dark brown very gravelly and cobbly loam to about 9 to 20 inches over stone and basalt bedrock. The soil is effervescent on surface to violently effervescent in substrata and is moderately alkaline (pH 8.2-8.3 TB). Lime content in filaments, soft masses, and lime coated gravels and cobbles increases with depth. Lime and ash may fill the fractured seam of basalt bedrock.

The soil is moderately permeable to bedrock. The effective rooting depth is depth of profile and in some of fracture seams. These soils are used mainly for range and grazing, wildlife and park areas.

Representative profile: North and east side of NE¼, Section 3, T25N, R8E, north side of small canyon.

All 0-1" (0-2.5 cm) -- Light gray (10YR 6/1) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse platy structure; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful very fine and fine roots; common very fine and fine vesicular and interstitial pores; 15 to 20 percent very fine and fine black (N2/) cinder gravel, 30 percent area has medium and large basalt stones; slightly effervescent, moderately alkaline (pH 8.2 TB); abrupt smooth boundary.

B1 1-3" (2.5-8 cm) -- Light gray (10YR 6/1) sandy loam, dark brown (10YR 3/3) moist; massive; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine, and few medium roots; common very fine and fine interstitial and few very fine tubular pores; 8 to 10 percent very fine and fine black (N2/) cinder gravel, very few basalt cobbles, slightly effervescent; moderately alkaline (pH 8.2 TB); abrupt smooth boundary.

B2 3-9" (8-23 cm) -- Grayish brown (10YR 5/2) light clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; plentiful very fine and fine, few medium roots; few very fine interstitial and tubular pores; 10 percent fine and medium black (N2/) cinder gravel and few rounded black (N2/) basalt cobbles; strongly effervescent; moderately alkaline (pH 8.3 TB); clear wavy boundary.

C1 9-15" (23-38 cm) -- Light brownish gray (10YR 6/2) very gravelly loam, grayish brown (10YR 5/2) moist; massive; hard, friable, sticky and plastic; few very fine interstitial and tubular pores; 40 percent very fine to medium black (N2/) cinder gravel, few small and medium black (N2/) basalt cobbles; violently effervescent; white (N8/) lime filaments and soft masses; moderately alkaline (pH 8.3 TB); clear wavy boundary.

C2ca 15" (38 cm) -- Dark gray (N4/) basalt bedrock, black (N2/) moist; very hard; bedrock fractured in many places; few very fine and fine roots; violently effervescent; white (N8/) soft lime masses in seams and cracks and as coatings on fractured planes, moderately alkaline (pH 8.3 TB).

Variations: Depth to basalt bedrock and stones ranges from 10 to 20 inches. Gravel and cobble content ranges from 10 to 40 percent in control section.

Hues of the A horizon are 10YR. Values are 5 and 6 dry and 3 moist; chromas are 1 or 2 dry and 2 to 4 moist. Texture of the A horizon is gravelly loam, gravelly sandy loam, cobbly sandy loam or stony sandy loam. Structure of the A horizon is generally weak coarse platy to massive. Stones on the surface in small areas range from 1 to 30 percent.

Bodies of this soil are usually on the edges and scarps off the mesa, or ridges of the mesas and plains. Small bodies of units 3E, 1A, sandstone rockland, and 1E, along with sandstone outcrop, are included in some areas of the steep slopes or scarps off the mesas.

1E - Cinder slopes

This mapping unit consists of black very fine to medium cinder gravel on slopes of 5 to 50 percent. The cinders have been wind drifted onto the slopes and scarps of the basalt mesas and limestone cliffs. Depths range from 20 to 60 inches or more. Vegetation is composed of about 40 percent cover consisting of shrubby buckwheats, Apacheplume, galleta, and chamiza. Erosion is severe. Runoff is low.

Typically, this mapping unit is composed of black (N2/) cinders to 24 to 60 inches deep. Some loamy cindery sand may be included. The cinders are rapidly permeable. Effective rooting depth is 24 to 30 inches. This soil is used for very limited grazing or range, wildlife, and as part of park area.

1F - Very coarse loamy sand on cinder cones, 8 to 40 percent slopes

This unit consists of well-drained soils over cinders. They are formed in place from cinders and basalt on the cinder cones of Doney Mountain.

Vegetation is composed of galleta, Indian ricegrass, threeawn, bush muhly, mormon-tea, green sagewort, spiny horsebrush, Apacheplume, aster, traces of skinkbush, yucca and juniper.

Typically, the surface soil is brown or dark brown, very gravelly (black and brown cindery) loamy sand, 1 to 7 inches thick. The underlying horizon is dark brown very gravelly loam and sandy loam, 3 to 14 inches thick. The substratum is dark reddish brown very gravelly cindery sandy loam or loamy sand, extending to 60 inches or more. The soil is noneffervescent or slightly effervescent on the surface to strongly effervescent in the substrata. They are moderately alkaline (pH 8.2-8.3 TB). Lime coatings are on the bottom of cinder pieces. The soil is moderately rapidly permeable. Effective rooting depth is 60 inches.

Representative profile: SE corner, SE$\frac{1}{4}$ Section 14, T25N, R9E, north slope of Doney Mountain from highway, Wupatki National Monument, Coconino County, Arizona.

A1 0-1" (0-2.5 cm) -- Pinkish gray (7.5YR 6/2) very gravelly cindery loamy sand, dark brown (7.5YR 4/2) moist; weak coarse platy structure; soft when dry, loose when moist, nonsticky and nonplastic when wet; few very fine and fine roots; common very fine and fine vesicular pores; 70 percent black (N2/) very fine to coarse cinders and few angular cobbles of basalt, very slightly effervescent; moderately alkaline (pH 8.2 TB); abrupt smooth boundary.

C1 1-7" (2.5-18 cm) -- Light brown gray (10YR 6/2) very gravelly cindery loamy sand, very dark gray brown (10YR 3/2) moist; single grain structure when dry; loose when dry or moist, nonsticky and nonplastic when wet; plentiful very fine and fine and few medium roots; common very fine and fine interstitial, few medium pores; 60 percent very fine to coarse black (N2/) cinders; very slightly effervescent; moderately alkaline (pH 8.2 TB); clear smooth boundary.

C2 7-11" (18-28 cm) -- Pinkish gray (5YR 6/2) very gravelly cindery loam, reddish brown (5YR 4/3) moist; massive; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine, few medium roots; common very fine and fine interstitial and common very fine tubular pores; 50 percent very fine to coarse black (N2/) cinders; slightly effervescent; moderately alkaline (pH 8.3 TB); clear smooth boundary.

C3ca 11-20" (28-51 cm) -- Reddish brown (5YR 5/3) very gravelly cindery sandy loam, reddish brown (5YR 4/3) moist; massive, slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine, few medium roots; common very fine, fine and medium vesicular, interstitial and tubular pores; 60 to 70 percent very fine to coarse black (N2/) cinders; strongly effervescent; moderately alkaline (pH 8.3 TB); clear smooth boundary.

C4ca 20-25" (51-64 cm) -- Weak red (2.5YR 5/2) very gravelly cindery loamy sand, dark reddish brown (2.5YR 3/4) moist; single grain structure; loose when dry or moist, nonsticky and nonplastic when

wet; plentiful very fine and fine, few medium roots; common very fine, fine, medium interstitial and vesicular pores and common very fine tubular pores; 60 percent very fine to coarse black (N2/) cinders; white (10YR 8/1) lime coatings on bottom of cinder pieces; strongly effervescent; moderately alkaline (pH 8.3 TB); clear smooth boundary.

C5ca 25-60" (64-152 cm) -- Light reddish brown (5YR 6/3) very gravelly loamy sand, dark reddish brown (5YR 3/3) moist; single grain structure, loose when dry or moist, nonsticky and nonplastic when wet; few very fine and fine roots; 60 percent very fine to coarse black (N2/) cinders; white (10YR 8/1) lime coatings on bottom of cinder pieces; strongly effervescent; moderately alkaline (pH 8.3 TB).

Variations: Hues of the surface soils range from 5YR to 10YR. Values are 6 dry and 3 or 4 moist. Chromas are 2 and 3 dry and 2 to 4 moist. Textures of the surface soils are loam, very gravelly sandy loam and very gravelly loamy sand. Structure of the surface soils are massive, weak coarse platy or single grain. Hues of the underlying horizon are 5YR to 7.5YR, values are 5 and 6 dry, 4 moist; chromas are 2 and 3 dry and 3 or 4 moist. Textures are loam, very gravelly sandy loam, very gravelly loamy sand. Hues of the substrata range from 2.5YR to 7.5YR, values from 5 to 6 dry and 3 to 4 moist. Chromas are 1 to 3 dry, 3 and 4 moist.

Small bodies of 1A and 1B occur within the unit. Runoff is slight to medium. Erosion hazard is moderate when overgrazed. This soil is used mainly for range or grazing wildlife, watershed and park area.

1H - Very gravelly cindery loam, 3 to 5 percent slopes

This mapping unit consists of well-drained soils. They are formed from basalt and cinders. Elevation is 4800 to 4900 feet. Vegetation is composed of mormon-tea, big bluestem, yucca, chamiza, shrubby buckwheats, sand sagebrush, Indian ricegrass and perennial forbs.

Typically, the surface layer is dark gray or black gravelly cindery sand or loamy sand about 9 inches thick. The subsoil is a dark brown gravelly cindery light sandy loam about 20 inches thick. The substratum is a brown to dark brown gravelly cindery sandy loam to 60 inches. The soil is weakly effervescent on the surface to violently effervescent in substrata. The profile is moderately alkaline (pH 8.2-8.5). A weakly cemented lime layer about 6 to 10 inches thick is at 24 inches depth. The soil is moderately rapid to rapidly permeable. Effective rooting depth is 30 to 40 inches.

Representative profile: In NE part of SE$\frac{1}{4}$, Section 30, T25N, R10E, south of main highway, Wupatki National Monument, Coconino County, Arizona.

A1 0-9" (0-23 cm) -- Very dark gray (10YR 3/1) very gravelly sand, black (10YR 2/1) moist; single grain structure; loose when dry or moist, nonsticky and nonplastic when wet; plentiful very fine and fine, few medium roots; common very fine and fine interstitial pores; 35 percent very fine and fine black cinder gravel; very slightly effervescent; moderately alkaline (pH 8.2 TB); clear smooth boundary.

B21 9-15" (23-38 cm) -- Brown (7.5YR 5/2) sandy loam, dark brown (7.5YR 3/2) moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful very fine and fine, few medium roots; common very fine interstitial, common very fine and fine tubular, few medium tubular pores; 10 percent very fine and fine black cinder gravel; effervescent; moderately alkaline (pH 8.2 TB); clear smooth boundary.

B22 15-24" (38-61 cm) -- Brown (7.5YR 5/2) gravelly cindery sandy loam, dark brown (7.5YR 4/2) moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful very fine and fine, few medium roots; common very fine interstitial, very fine and fine tubular and few medium tubular pores; 15 percent very fine and fine black cinder gravel; strongly effervescent; moderately alkaline (pH 8.3 TB); clear smooth boundary.

B23ca 24-30" (41-76) -- Pinkish gray (7.5YR 6/2) gravelly cindery sandy loam, brown (7.5YR 5/4) moist; massive; slightly hard when dry, very friable (brittle) when moist; nonsticky and nonplastic when wet; plentiful very fine and fine and few medium roots; common very fine and fine interstitial and tubular pores; 15 to 20 percent cinder gravel; violently effervescent; fine white (7.5YR 8/0) lime filaments and pinkish white (7.5YR 8/2) soft lime masses; moderately alkaline (pH 8.4 TB); clear smooth boundary.

C1ca 30-37" (76-94 cm) -- Light brownish gray (10YR 6/2) gravelly cindery sandy loam, brown (10YR 4/3) moist; massive; slightly hard and hard when dry, very friable when moist; nonsticky and nonplastic when wet; few very fine roots; few very fine and fine interstitial pores; 15 to 20 percent very fine and fine black cinder gravel; violently effervescent; white (10YR 8/1) weakly cemented lime pan; moderately alkaline (pH 8.4 TB), clear smooth boundary.

C2 37-60" (94-152 cm) -- Pinkish gray (7.5YR 6/2) gravelly sandy loam, brown (7.5YR 4/4) moist; massive; soft to slightly hard when dry; very friable when moist, nonsticky and nonplastic when wet; no roots; common very fine and fine interstitial pores; 15 to 20 percent very fine and fine black cinder gravel; violently effervescent; moderately alkaline (pH 8.5 TB).

Variations: Depths of the profile ranges from 28 to 60 inches or more to an indurated pan or buried sandstone on shale material. Gravel content in control section is usually 5 to 40 percent of cinder gravel but may have few rounded large gravels and cobbles of basalt, quartzite and limestone.

Hues of surface layer are 7.5YR and 10YR. Values are 3 dry and 2 moist. Chromas are 0 and 1 dry and 9 and 1 moist. Textures of the surface are gravelly sand or sand. Values of the control section range from 5 to 6 dry and 3 to 5 moist. Chromas are 2 and 4 dry and moist. Textures of the control section are sandy loam or gravelly sandy loam. Structure is singlegrain, weak medium subangular blocky or massive. Hues of the substrata are 7.5YR and 10YR. Values are 6 and 4 moist, chromas are 2 and 4 dry, 3 and 4 moist.

Small bodies of 1E - Cinder slopes occur along with this mapping unit as small dunes. This soil is moderately rapidly permeable. Runoff is slight. Erosion hazard is slight to moderate with moderate wind erosion as evidenced by hummocky appearance. Present use is grazing or range, wildlife, watershed and park area.

1J - Very gravelly loam on pumice, 3 to 8 percent slopes

This mapping unit consists of well-drained soils over pumice fragments. They are formed in place in a small area east of Doney Mountain from pumice and basalt cinders over very old fans or beds of pumice with a more recent admixture of basaltic cinder material. Elevation is 4900 to 5000 feet. Vegetation is mainly black grama, galleta, mormon-tea, chamiza, bush muhly, spiny horsebrush, and traces of rabbitbrush, needleandthread, annual buckwheats and other forbs.

Typically, the surface layers consist of a thin mulch of fine black cinders on a dark reddish brown very cindery sandy loam, 3 inches thick. This is underlain by dark brown gravelly or very gravelly sandy loam, 18 to 20 inches thick. The substratum is a brown very gravelly (pumice) sandy loam 24 to 36 inches thick. The soil is noneffervescent on the surface but becomes increasingly effervescent with depth, with lime coatings on pumice and cinder fragments below 10 inches. These soils are moderately to strongly alkaline (pH 8.1 to 9.0 TB).

This soil is moderately rapidly permeable. Effective rooting depth is 20 to 24 inches. Erosion hazard is slight. These soils are used mainly for grazing or range, wildlife, watershed and park area.

Representative profile: South part of SW$\frac{1}{4}$, Section 13, T25N, R9E, north of road, Wupatki National Monument, Coconino County, Arizona.

A11 0-1" (0-2.5 cm) -- Very dark gray (N3/) very gravelly cindery loamy sand, black (N2/) moist, single grain structure, loose when dry or moist, nonsticky and nonplastic when wet; no roots, very porous; 60 percent very fine to medium black (N2/) cinder gravel; noneffervescent; moderately alkaline (pH 8.1 TB);abrupt smooth boundary.

A12 1-2" (2.5-5 cm) -- Reddish gray (5YR 5/2) very gravelly sandy loam, dark reddish brown (5YR 3/3) moist; weak coarse platy structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; few very fine and fine roots; common very fine and fine vesicular and interstitial pores; 50 percent cinder gravel; noneffervescent; moderately alkaline (pH 8.2 TB);abrupt smooth boundary.

C1 2-4" (5-10 cm) -- Brown (7.5YR 5/2) very gravelly sandy loam, dark brown (7.5YR 3/2) moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful very fine and fine, few medium roots; common very fine and fine interstitial pores; 35 to 50 percent gravel of basalt cinders and pumice; effervescent; moderately alkaline (pH 8.2 TB); clear smooth boundary.

C2 4-8" (10-20 cm) -- Brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3); massive; slightly hard when dry, very friable when

moist, nonsticky and nonplastic when wet; plentiful very fine, fine, few medium roots; common very fine and fine interstitial pores; 30 percent pumice and some basaltic cinders; effervescent; moderately alkaline (pH 8.3 TB); clear smooth boundary.

C3ca 8-20" (20-51 cm) -- Brown (7.5YR 5/2) very gravelly sandy loam, dark brown (7.5YR 4/2) moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful very fine and fine, few medium roots; common very fine and fine interstitial pores; 40 to 50 percent pumice fragments; strongly effervescent; lime coated fragments (7.5YR 8/1) dry (7.5YR 7/2) moist; moderately alkaline (pH 8.3 TB); clear smooth boundary.

C4ca 20-60" (51-152 cm) -- Brown (7.5YR 5/2) very gravelly sandy loam, dark brown (7.5YR 4/2) moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; very few very fine to no roots; very porous fragments; 40 to 50 percent pinkish gray (7.5YR 7/2) gravel and cobble (pumice), pinkish gray (7.5YR 6/2) moist; violently effervescent; moderately alkaline (pH 8.4 TB).

Variations: Depths to pumice fragments 20 to 24 inches. Hues of the surface layer are 5YR, 7.5YR and 10YR; values 3 and 5 dry, 2 and 3 moist. Chromas are 0, 1, and 3 dry, 1 and 3 moist. Hues of C1 and C2 are 7.5YR and 10YR. Values are 5 and 6 dry, 3 and 4 moist. Chromas are 2 and 3 dry, 2 and 3 moist. Hues of the substrata are 7.5YR and 10YR. Values are 5, 6, and 7 dry; 3, 4, and 6 moist. Chromas are 2 and 3 dry, 2 and 3 moist. Profile is generally moderately alkaline but may be very strongly alkaline (pH 9.0 TB) in substrata.

2A - Cindery loam, very shallow on sandstone, 0 to 5 percent slopes

Soils in this unit are well drained and were formed in place on the sandstone and shale on the mesas and plains of the Moenkopie formation. Elevation is approximately 5400 feet. Vegetative cover is 40 to 60 percent and includes galleta, black grama, threeawn, needleandthread, oneseed juniper, rabbitbrush and traces of blue grama.

Typically, the surface layers are dark brown gravelly cindery sandy loam about 2 to 3 inches thick. The underlying horizon is reddish brown loam about 2 to 3 inches thick. The substratum is a reddish brown or dark reddish brown very gravelly clay loam weathered shales and sandstones about 7 or 8 inches in depth to sandstone bedrock. The soil is weakly to violently effervescent, and is moderately alkaline. It is moderately permeable to bedrock or shales. Effective rooting depth is 8 to 9 inches or deeper in the bedrock crevices. Runoff is slow to medium. Erosion is moderate to severe if not covered with vegetation. These soils are used for limited grazing or range, wildlife, watershed and park area.

Representative profile: SE$\frac{1}{4}$ Section 16, T25N, R9E, east of highway along Forest Service fence, Wupatki National Monument, Coconino County, Arizona.

A11 0-$\frac{1}{2}$" (0-1.5 cm) -- Brown (7.5YR 5/2) very gravelly cindery loamy sand, dark brown (7.5YR 3/2) moist; weak coarse platy structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; few very fine and fine roots; common very fine and

fine vesicular and interstitial pores; 50 percent very fine and fine black cinder gravels; weakly effervescent; moderately alkaline (pH 8.2 TB); abrupt smooth boundary.

A12 ½-1" (1.5-2.5 cm) -- Brown (7.5YR 5/2) very gravelly sandy loam, dark brown (7.5YR 3/2) moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when wet; few very fine and fine roots; common very fine and fine interstitial pores; 35 percent very fine and fine black cinder gravel; effervescent; moderately alkaline (pH 8.3 TB); abrupt smooth boundary.

A13 1-3" (2.5-8 cm) -- Reddish gray (5YR 5/2) gravelly loam, dark reddish brown (5YR 3/4) moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful very fine, fine, and few medium roots; common very fine and fine interstitial and tubular, few medium tubular pores; 15 percent very fine and fine black cindery gravels; effervescent; moderately alkaline (pH 8.3 TB); clear smooth boundary.

C1 3-5" (8-13 cm) -- Reddish brown (5YR 5/3) loam, reddish brown (5YR 4/4) moist; weak medium subangular blocky structure; hard when dry, friable when moist, slightly sticky and plastic when wet; plentiful very fine and fine roots; few very fine and fine interstitial and tubular pores; 10 percent very fine black cindery gravels; strongly effervescent; moderately alkaline (pH 8.3 TB); clear smooth boundary.

C2ca 5-8" (13-20 cm) -- Weak red (2.5YR 5/2) very gravelly clay loam,dark reddish brown (2.5YR 3/4) moist; moderate medium subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; plentiful very fine and fine roots; common very fine and fine interstitial and tubular, and few medium tubular pores; 50 to 60 percent fine to coarse sandstone-shale fragments, very few black cinder gravel; violently effervescent; few white (5YR 8/1) lime filaments and soft masses; moderately alkaline (pH 8.3 TB); abrupt smooth boundary.

R 8" (20 cm) -- Reddish gray (2.5YR 5/2) and dark reddish brown (2.5YR 3/4) moist, very hard sandstone bedrock, fractured frequently, violently effervescent; moderately alkaline (pH 8.3 TB).

Variations: Depths to bedrock range from 4 to 10 inches. Coarse fragment content in surface varies from 5 to 70 percent. In some areas cinders are thicker on the surface. Sandstone and shale fragments dominate substrata.

Hues of the surface soil are 2.5YR, 5YR, 7.5YR. Values are 5 and 6 dry, 3 and 4 moist. Chromas are 2, 3, and 4 dry; 2, 3, and 4 moist. Surface textures are loam, gravelly loam, gravelly sandy loam, very gravelly sandy loam, gravelly loamy sand, very gravelly loamy sand. Structures are weak coarse platy single grain or massive. Hues of the A13 and C1 are 2.5YR, 5YR, and 10YR. Values are 4, 5, and 6 dry; 3 and 4 moist; chromas are 2, 3, and 4 dry; 3, 4, and 6 moist. Textures are clay loam, loam, gravelly loam. Structures are massive, weak coarse platy, and weak medium, subangular blocky. Colors of the C2ca vary with the parent rock and textures vary with the amount of shale interbedded with the weathered sandstone strata. Sandstone bedrock strata vary in thickness and are interbedded with softer shales.

2C - Very shallow gravelly loam-Sandstone outcrop rockland complex, 3 to 30 percent slopes

This complex consists of 40 to 60 percent of very shallow gravelly loam on sandstone, 0 to 3 percent slopes and 25 to 40 percent sandstone outcrop, 3 to 30 percent slopes. The very shallow gravelly loam, 0 to 3 percent slopes, is located on the almost flat slopes or on fans and plains over the Moenkopie formation. Sandstone outcrops are on breaks or scarps and on plains of the Moenkopie formation. Included is 10 to 20 percent of unit 2A which is described previously. The very shallow gravelly loam soil on sandstone, 0 to 3 percent slopes, is not mapped separately but is described below as part of this complex.

Vegetative cover of the very shallow loams is 25 to 40 percent, consisting of alkali sacaton, shadscale, mormon-tea, broom snakeweed, bush muhly, chamiza, rabbitbrush, and traces of aster, fluffgrass, cactus, globemallow and Russianthistle.

Erosion is slight to moderate. Permeability is moderate. Runoff is moderate to rapid. Effective rooting depth is 4 to 7 inches except on rock outcrop. Present use is for very limited grazing or range, wildlife, watershed and park area.

A representative profile of the Very shallow gravelly loam, 0 to 3 percent slopes is described in the SW part SW$\frac{1}{4}$ of Section 14, T25N, R10E, north of road, Wupatki National Monument, Coconino County, Arizona.

A11 0-$\frac{1}{2}$" (0-1.5 cm) -- Reddish brown (5YR 5/4) very gravelly sandy loam, dark reddish brown (5YR 3/4) moist; single grain structure; loose when dry, soft when moist, nonsticky and nonplastic when wet; many very fine and fine interstitial pores; 70 percent fine to medium flat sandstone fragments and few medium and coarse quartzitic pebbles; effervescent; moderately alkaline (pH 8.2 TB); abrupt smooth boundary.

A12 $\frac{1}{2}$-2" (1.5-5 cm) -- Reddish brown (2.5YR 5/4) loam, reddish brown (2.5YR 4/4) moist; weak coarse platy structure; slightly hard when dry, very friable when moist, slightly sticky and plastic when wet; common very fine and fine, few medium vesicular, common very fine and fine interstitial pores; strongly effervescent; moderately alkaline (pH 8.3 TB); abrupt smooth boundary.

C1 2-7" (5-18 cm) -- Weak red (2.5YR 4/2) gravelly sandy loam, dark reddish brown (2.5YR 3/4) moist; massive; slightly hard when dry, very friable when moist, slightly sticky and slightly plastic when wet; common very fine and fine, few medium vesicular, many fine and medium thin flat sandstone-shale fragments; strongly effervescent; moderately alkaline (pH 8.3); abrupt smooth boundary.

R 7" (18 cm) -- Reddish brown (5YR 5/3) very hard sandstone, dark reddish brown (5YR 3/3) moist; strongly effervescent; moderately alkaline (pH 8.3 TB).

Variations: Thickness of this soil to sandstone bedrock is 4 to 7 inches. Sandstone gravel content ranges from 15 to 70 percent.

Hues of the surface layers are 2.5YR and 5YR. Chromas are 3 and 4. Textures range from very gravelly or channery sandy loam, gravelly sandy loam, sandy loam, loam or gravelly loam. Structures are single grain and weak coarse platy. Values of the C1 horizon are 4 and 5 dry; chromas are 2 and 4 dry. Textures range from gravelly sandy loam, loam and very gravelly loam. Structures of C1 horizons are massive, moderate coarse platy, or weak medium subangular blocky.

The sandstone rock outcrop is interbedded with softer sandy or clayey shales and range in color from light reddish brown to dark reddish brown. With some bluish grey or purple members, occasional gypsum seams are found. The complexity of the slopes below Doney Cliffs often interfere with movement of livestock. Erosion is active in many areas. Vegetative cover in the rougher areas having large amounts of outcrop include small amounts of black grama, chamiza, Apacheplume, skunkbush, brickellbush, princesplume and traces of shrubby buckwheats, spiny horsebrush and one-seed juniper.

2H - Very cindery loam-Sandstone outcrop complex, 0 to 30 percent slopes

This complex consists of 40 to 60 percent 2J - Very cindery loam, very shallow on sandsone and 30 to 40 percent of 2C - Very shallow gravelly loam-Sandstone outcrop complex. Unit 2J - Very cindery loam, very shallow on sandstone is located on the level and gently sloping fans and depressions. Unit 2C is located on the steeper slopes of mesas and on breaks and scarps. Included are about 10 to 20 percent of Unit 2A.

This complex covers large acreages of country underlain by the Moenkopie formation. Vegetation is composed of 20 to 40 percent cover consisting of chamiza, galleta, threeawns, black grama, Apacheplume, mormon-tea, broom snakeweed, bush muhly, annual buckwheats, fluffgrass, and traces of princesplume, spiny horsebrush, brickellbush and Russianthistle.

Present use is limited grazing or range, watershed, and park area.

2J - Very cindery loam, very shallow on sandstone, 0 to 5 percent slopes

This mapping unit consists of well-drained soils. They are formed in place from sandstone and interbedded shales and cinders blown from the adjacent cinder cones onto the mesas and fans underlain by the Moenkopie formation. Elevation is 4600 to 4900 feet. Vegetation is made up of 20 to 60 percent cover of chamiza, mormon-tea, sand sagebrush, rabbitbrush, galleta, bush muhly, broom snakeweed, spiny horsebrush, brickellbush, Apacheplume, Russianthistle, and traces of Indian ricegrass, silverleaf nightshade, black grama, fluffgrass, and annual buckwheat.

Typically, the surface soils are dark reddish brown very gravelly cindery loamy sand and sandy loam about 5 to 9 inches thick. The subsurface layer is a dark reddish brown gravelly cindery sandy loam or loam about 4 to 6 inches thick over sandstone bedrock.

The soil is moderately rapid to moderately permeable. Effective rooting depth is 12 to 16 inches. Small bodies of sandstone rockland (breaks) may be included. Runoff is medium. Erosion hazards become more severe on

overgrazed more sloping areas. Present use is for limited grazing or range, wildlife and watershed.

Representative profile: NE part of NE¼, Section 30, T25N, R10E, north of road, Wupatki National Monument, Coconino County, Arizona.

A11 0-1" (0-2.5 cm) -- Reddish gray (5YR 5/2) very gravelly (cindery) loamy sand, dark reddish brown (5YR 3/3) moist; weak coarse platy structure; soft when dry, very friable when moist, nonsticky and nonplastic when wet; very few very fine roots; common fine and medium vesicular, common very fine and fine interstitial pores; 50 to 60 percent very dark gray (5YR 3/1) cinder gravel, black (5YR 2/1) moist; effervescent, moderately alkaline (pH 8.0 TB); abrupt smooth boundary.

A12 1-7" (2.5-20 cm) -- Reddish gray (5YR 5/2) very gravelly (cindery) sandy loam, dark reddish brown (5YR 3/3) moist; single grain structure; loose when dry or moist, nonsticky and nonplastic when wet; plentiful very fine and fine, few medium roots; common very fine and fine interstitial pores; 35 percent very fine and fine black (N2/) cinder gravel and few small sandstone fragments; effervescent; moderately alkaline (pH 8.0 TB); abrupt smooth boundary.

C1ca 8-12" (20-30 cm) -- Reddish brown (5YR 5/3) very gravelly sandy loam, dark reddish brown (5YR 3/4) moist; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; plentiful very fine and fine roots; common very fine and fine interstitial, few very fine tubular pores; 50 percent fine and medium reddish brown (5YR 5/3) sandstone and shale fragments; strongly effervescent; few fine white (5YR 8/1) lime filaments; moderately alkaline (pH 8.2 TB); abrupt smooth boundary.

R 12" (30 cm) -- Reddish brown (5YR 5/3) very hard sandstone, dark reddish brown (5YR 3/3) moist; violently effervescent; moderately alkaline (pH 8.2).

Variations: Thickness of this soil to sandstone bedrock is 9 to 16 inches. Content of cinder or sandstone and shale fragments ranges from 15 to 60 percent, with the cinders at surface and the sandstone and shale fragments above bedrock.

Hues of the surface layers are 5YR, 7.5YR and 10YR. Values are 3, 4, and 5 dry; 2 and 3 moist. Chromas are 1, 2, 3, and 4 dry; 1, 2, 3, and 4 moist. Textures of the surface layers are gravelly sand, gravelly loamy sand, very gravelly loamy sand, very gravelly sandy loam. Hues of the subsoils are controlled by color of original rock and range through 10R, 2.5YR, 5YR, and 10YR. Values are 4 and 5 dry, 3 and 4 moist; chromas are 2, 3, and 4 dry, 2, 4, and 6 moist. The subsoils are clay loam, loam, very gravelly loam, gravelly clay loam, very gravelly and sandy loam. Subsoils may become strongly alkaline (pH 8.5-9.0). Amounts of lime filaments and soft masses in subsoils vary considerably.

3A - Gravelly loam, shallow on limestone, 0 to 3 percent slopes

These well-drained soils are formed in the limestone and calcareous sandstones of the Kaibab formation on mesas and plains. Elevation is 5300 to 5400 feet. Vegetation is composed of 45 to 60 percent cover in which the following species are important: galleta, needleandthread, alkali sacaton, rabbitbrush, globemallow, black grama, broom snakeweed, oneseed juniper, sideoats, and traces of cactus, Russianthistle, fluffgrass, threeawn, chamiza, paperdaisy, woolly groundsel, blue grama.

Typically, the surface soils are a dark brown gravelly (cindery) loam about 2 to 3 inches thick. The underlying horizons are a dark brown loam or clay loam about 2 to 5 inches thick. The substratum is yellowish brown to reddish brown clay loam or loam about 3 to 4 inches over limestone bedrock.

The soil is moderately permeable. Effective rooting depth is 8 to 14 inches. Runoff is slow to moderate. Erosion is slight to moderate. This soil is used for grazing or range, wildlife, watershed and park area.

Representative profile: SW part of NE$\frac{1}{4}$, Section 4, T25N, R9E, photo 1-22, Wupatki National Monument, Coconino County, Arizona.

A11 0-1" (0-2.5 cm) -- Brown (10YR 5/3) very gravelly sand, dark brown (10YR 3/3) moist; single grain structure; loose when dry or moist, nonsticky and nonplastic when wet; few medium and coarse roots; common very fine, fine and medium vesicular and interstitial pores; 35 to 40 percent very fine, fine and medium black (N2/) cinder gravel and few angular cobbles of limestone; weakly effervescent; moderately alkaline (pH 8.0 TB); abrupt smooth boundary.

A12 1-2" (2.5-5 cm) -- Brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; massive; hard when dry, friable when moist, sticky and plastic when wet; few medium and coarse roots; common very fine and fine interstitial and vesicular pores; 20 percent very fine and fine black (N2/) cinder gravel; effervescent; moderately alkaline (pH 8.2 TB); abrupt smooth boundary.

C1 2-4" (5-10 cm) -- Brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) moist; massive; hard when dry, friable when moist, sticky and plastic when wet; few medium and coarse roots; common very fine and fine interstitial, few very fine tubular pores; 5 percent very fine cinder gravel; strongly effervescent; moderately alkaline (pH 8.2 TB); clear smooth boundary.

C2ca 4-9" (10-23 cm) -- Reddish brown (5YR 5/3) clay loam; reddish brown (5YR 4/3) moist; weak medium subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; plentiful very fine and fine, few medium, roots; common very fine and fine interstitial and tubular, few medium tubular pores; 2 to 3 percent very fine and fine black (N2/) cindery gravels and few angular coarse gravels and cobbles of limestone; violently effervescent, few white (5YR 8/2) lime filaments and soft masses; moderately alkaline (pH 8.3 TB); clear smooth boundary.

C3ca 9-13" (23-33 cm) -- Pinkish gray (7.5YR 6/2) very gravelly loam, brown (7.5YR 5/4) moist; massive; hard when dry, friable when

moist, sticky and plastic when wet; plentiful very fine and fine roots; common very fine and fine interstitial, few very fine and fine tubular pores; 30 to 40 percent very fine to medium black (N2/) cinder gravel and few coarse pebbles and cobbles of limestone; violently effervescent; many white (7.5YR 8/2) soft lime masses and concretions; moderately alkaline (pH 8.3 TB); abrupt smooth boundary.

R 13" (33 cm) -- Very pale brown (10YR 7/4) massive very hard limestone, light yellowish brown (10YR 6/4) moist; irregularly spaced cracks or joints and seams; extremely hard; violently effervescent; moderately alkaline (pH 8.3 TB).

Variations: Thickness of this soil to limestone is 5 to 13 inches, averaging about 8 inches. Coarse fragments, mainly cinders on the surface and some limestone cobbles and stones in the subsurface layers, range from a trace to 50 percent. Hues of the surface soils are 7.5YR and 10YR. Values are 3, 4, 5, or 6 dry; 2, 3, or 4 moist. Chromas are 1, 2, or 3 dry and moist. Textures of the surface soils are loam, gravelly loam, sandy loam, gravelly sandy loam, very gravelly sandy loam, very gravelly loamy sand on very gravelly sand. Structure ranges from single grain through weak coarse platy to massive. Hues of the C1 horizons are 7.5YR and 10YR; values are 4, 5, and 6 dry; 3 and 4 moist. Chromas are 2, 3, and 4 dry and moist. Textures of the C1 horizon are loam, gravelly loam or clay loam. Hues of the Cca horizon are 2.5YR, 5YR, 7.5YR and 10YR; values are 4, 5, and 6 dry; 3, 4, and 5 moist; chromas are 2, 3, and 4 dry; and 2, 3, and 4 moist. Textures of the substrata are loam, gravelly loam, very gravelly loam and clay loam. Structures of the substrata are massive and weak medium subangular blocky.

Small bodies of Units 3B and 3C are included.

3B - Gravelly loam-Limestone outcrop complex, 0 to 3 percent slopes

This complex consists of about 50 to 70 percent 3A Gravelly loam, shallow on limestone, 0 to 3 percent slopes, and 25 to 35 percent of limestone outcrop. Both are located on the same plain and are on gentle slopes. Limestone outcrop occurs in small depressions or slight ridges. Included are 5 to 15 percent of Unit 3C and Unit 3A.

This complex has about 50 to 70 percent vegetative cover consisting of black grama, galleta, needleandthread, alkali sacaton, rabbitbrush, broom snakeweed, and traces of woolly groundsel, blue grama, cactus, zinnia, and some juniper in some areas. Present use is grazing or range, watershed, and park area.

3C - Cindery loam-Limestone outcrop complex, 0 to 3 percent slopes

This complex consists of 20 to 25 percent of Unit 3A Gravelly loam, shallow on limestone, 0 to 3 percent slopes, 35 to 50 percent of cindery loam, shallow on limestone, 0 to 3 percent slopes, and 30 percent of limestone outcrop. All occur on gentle slopes and plains. The outcrop is exposed as barren, spotty areas of limestone bedrock and limestone fragments within the soil areas. The 3A gravelly loam, shallow on limestones, 0 to 3 percent slopes, has profile described as representative of the mapping unit. The cindery loam, shallow on limestone, 0 to 3 percent slopes, is also

similar but has a very cindery surface of 3 to 5 inches. This soil dominates this mapping unit.

Vegetation consists of about 45 to 60 percent cover, mainly galleta, black grama, alkali sacaton, needleandthread, oneseed juniper, rabbitbrush, and traces of chamiza, broom snakeweed and sideoats grama. Present use is grazing or range, watershed, and park area.

3E - Gravelly loam-Limestone rockland complex, 3 to 15 percent slopes

This complex is about the same as 3B Gravelly loam-Limestone outcrop complex, 0 to 3 percent slopes, except it occupies steeper slopes on scarps and in canyons. Also, the limestone outcrop is about 50 to 60 percent and the remainder is covered with shallow soils. Runoff is rapid and erosion is severe. Vegetation consists of 40 percent cover of galleta, shadscale, broom snakeweed, alkali sacaton, black grama, and traces of shrubby buckwheats, cactus, and Indian ricegrass. Present use is limited grazing or range, watershed, and park area.

4E - Gravelly loam alluvium, 0 to 3 percent slopes

These are well-drained alluvial soils from basalt, cinders, limestone and sandstone deposited on the Moenkopi sandstone plains. Vegetation is composed of 65 to 70 percent plant cover of galleta, rabbitbrush, alkali sacaton, chamiza, Russianthistle, mormon-tea, globemallow, bush muhly, Indian ricegrass, Apacheplume, sand sagebrush, traces of needleandthread, zinnia and juniper.

Typically, the surface or A horizon is a very dark gray and dark reddish brown gravelly sandy loam about 4 to 8 inches thick. The C horizons are reddish brown gravelly loam from 12 to 32 inches. The unconforming underlying soil from shale is a reddish brown very gravelly sandy loam from 32 to 40 inches. The soil is weakly to violently effervescent throughout. It is moderately alkaline on the surface to strongly alkaline in the lower subsoil. A fragmental or softly cemented lime-silica pan, 2 to 4 inches thick, is present at depths of 20 to 38 inches.

The soil is moderately to moderately rapidly permeable. Effective rooting depth is 24 to 40 inches. Erosion is slight to moderate. Runoff is slow to medium.

This soil is used for limited grazing or range, wildlife, watershed, and park areas.

Representative profile: NE part of NW$\frac{1}{4}$, Section 32, T25N, R10E, north of road from Wukoki Ruin, Wupatki National Monument, Coconino County, Arizona.

All 0-1" (0-2.5cm) -- Dark gray (5YR 4/1) gravelly loamy sand, very dark gray (5YR 3/1) moist; weak coarse platy structure, soft when dry, very friable when moist, nonsticky and nonplastic when wet; few very fine and fine roots, common very fine interstitial and vesicular pores; 25 percent very fine cinder gravel, few small rounded basalt cobbles; weakly effervescent; moderately alkaline (pH 8.5 TB); abrupt smooth boundary.

A12 1-3" (2.5-8 cm) -- Dark gray (5YR 4/1) gravelly loam, dark reddish brown (5YR 3/2) moist; massive; soft when dry, very friable when moist; nonsticky and nonplastic when wet; plentiful very fine and fine roots; common very fine and fine interstitial pores; 25 percent very fine to coarse cinder gravel; weakly effervescent; moderately alkaline (pH 8.3 TB); clear smooth boundary.

A13 3-8" (8-20 cm) -- Brown (7.5YR 5/2) gravelly sandy loam, dark brown (7.5YR 3/2) moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful very fine and fine, few medium roots; common very fine and fine interstitial, few very fine and fine tubular pores; 15 percent very fine and fine cinder gravel; strongly effervescent; moderately alkaline (pH 8.3 TB); clear smooth boundary.

C1 8-12" (20-30 cm) -- Pinkish gray (5YR 6/2) gravelly loam, reddish brown (5YR 1/4) moist; massive, slightly hard when dry, very friable when moist, sticky and plastic when wet; plentiful very fine and fine roots; common very fine and fine interstitial and tubular pores; 15 percent very fine to medium cinder gravel; strongly effervescent; strongly alkaline (pH 8.8 TB), clear smooth boundary.

C2ca 12-20" (30-51 cm) -- Reddish brown (5YR 5/4) gravelly sandy loam, reddish brown (5YR 4/4) moist; massive; hard when dry, friable when moist, nonsticky and nonplastic when wet; few very fine and fine roots; common very fine and fine interstitial and tubular, few medium tubular pores; weakly cemented, white (N8/) discontinuous lime-silica pans, 15 to 20 percent very fine to medium cinder gravel and few small rounded basalt and quartzite cobbles; violently effervescent, strongly alkaline (pH 8.8 TB); clear smooth boundary.

C3cam 20-24" (51-61 cm) -- White (5YR 8/1) strongly cemented lime-silica fragmental pan, pinkish gray (5YR 6/2) moist, massive, very hard and brittle, no roots; common very fine and fine interstitial, and few fine tubular pores; 15 to 20 percent very fine cinders; violently effervescent; strongly alkaline (pH 8.9 TB); abrupt smooth boundary.

C4ca 24-32" (61-81 cm) -- Dark reddish gray (5YR 4/2) very gravelly sandy loam, dark reddish brown (5YR 3/3) moist; massive,slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; no roots, many coarse interstitial pores; 35 percent very fine and fine cinder gravel, few rounded basalt and quartzite cobbles; white (5YR 8/1) lime coatings on gravels and cobbles violently effervescent; strongly alkaline (pH 8.7 TB); clear smooth boundary.

IIC5 32-36" (81-91 cm) -- Light reddish brown (5YR 6/3) gravelly clay loam, reddish brown (5YR 4/4) moist; massive; slightly hard when dry, friable when moist, sticky and plastic when wet; 20 to 25 percent fine and coarse thin flat sandstone and shale gravel; violently effervescent; strongly alkaline (pH 8.7 TB), clear smooth boundary.

R 36-40" (91-102 cm) -- Reddish brown (5YR 5/3), reddish brown (5YR 4/3) when moist, hard sandstone; violently effervescent,strongly alkaline (pH 8.6 TB). Interbedded with sandy and clayey shales.

Variations: Depth to sandstone and shale ranges from 31 to 48 inches or more. Coarse fragments range from a trace to 60 percent but generally are between 15 and 25 percent and consist of cinders, basalt and limestone. Depth to cemented pan ranges from 20 to 40 inches.

Hues of the surface soils are 5YR and 7.5YR. Values are 4 to 6 dry, 3 and 4 moist; chromas are 1 to 3 dry and moist; surface textures are gravelly loamy sand, loamy sand, sandy loam, gravelly sandy loam and very gravelly sandy loam. Surface structures are massive, single grain and weak coarse subangular blocky. Hues of the C horizons are 5YR or 7.5YR. Values are 5 and 6 dry; chromas are 2 to 4 dry and 3 or 4 moist. Subsoil textures are loamy gravelly loam, and gravelly sandy loam. Values of the IIc are 4, 6,and 8 dry; 3, 4, and 6 moist; chromas are 1, 2, and 3 dry; 2, 3, and 4 moist. Textures of soils are very gravelly sandy loam and gravelly clay loam.

4F - Loam alluvium, 0 to 3 percent slopes

Soils in this unit are well drained and are formed from alluvium from sandstone, shales, basalt and limestone on floodplains near the Colorado River. Slopes range from 0 to 3 percent but are dominantly less than 1 percent. Vegetation is a 45 to 50 percent cover of alkali sacaton, galleta, chamiza, shadscale, rabbitbrush, mormon-tea, Russianthistle, and traces of perennial forbs.

Typically, the surface layer is a yellowish red loam about 2 to 5 inches thick. The underlying layers are yellowish red and dark red loam to about 30 to 34 inches. Below these a dark reddish brown heavy loam extends to 60 inches or more. The soil is strongly to violently effervescent, moderately alkaline, pH 7.8 to 8.0, and contains some gypsum crystals. The soil is moderately permeable, and has an effective rooting depth of 36 to 48 inches. Erosion is slight.

This soil is used mainly for grazing or range, wildlife and watershed.

Representative profile: NE part of SW$\frac{1}{4}$, Section 1, T25N, R10E, south of roadway, photo 050, Wupatki National Monument, Coconino County, Arizona.

A11 0-1$\frac{1}{2}$" (0-4 cm) -- Light reddish brown (5YR 6/4) loam, yellowish red (5YR 4/6) moist; weak coarse platy structure; soft to slightly hard when dry, very friable when moist, sticky and plastic when wet; few very fine roots; common very fine and fine vesicular and interstitial pores; effervescent; mildly to moderately alkaline (pH 7.8 TB and BTB); abrupt smooth boundary.

A12 1$\frac{1}{2}$-2" (4-5 cm) -- Light reddish brown (5YR 6/4) loam; yellowish red (5YR 4/6) moist; massive; soft when dry, very friable when moist, nonsticky and nonplastic when dry; few very fine roots; common very fine and fine interstitial and vesicular pores; many very fine and fine pinkish white (5YR 8/2) gypsum and salt crystals; strongly effervescent; mildly alkaline (pH 7.8 BTB); abrupt smooth boundary.

C1 2-7" (5-18 cm) -- Light yellowish brown (5YR 6/4) sandy loam, yellowish red (5YR 4/6) moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; plentiful

very fine and fine roots; common very fine and fine interstitial, few fine and medium vesicular pores; many fine pinkish white (5YR 8/2) gypsum crystals and filaments; strongly effervescent; mildly alkaline (7.6 BTB); clear smooth boundary.

C2 7-24" (18-61 cm) -- Yellowish red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; massive; slightly hard when dry, very friable when moist; slightly sticky and slightly plastic when wet; plentiful very fine and fine, few medium roots; common very fine and fine interstitial, few very fine and fine tubular pores;strongly effervescent; mildly alkaline (pH 7.6 BTB); clear smooth boundary.

C3 24-36" (61-91 cm) -- Reddish brown (2.5YR 5/4) loam, dark red (2.5YR 3/6) moist; massive; slightly hard to hard when dry, friable when moist, sticky and plastic when wet; plentiful very fine and fine roots; common very fine and fine interstitial and tubular, few medium tubular pores; many pinkish white (5YR 8/2) lime and/or gypsum filaments and crystals; strongly effervescent; mildly alkaline (pH 7.6 BTB); clear smooth boundary.

C4 36-46" (91-117 cm) -- Reddish brown (2.5YR 5/4) sandy loam, dark reddish brown (2.5YR 3/4) moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; few very fine and fine roots; few very fine and fine interstitial and tubular pores; strongly effervescent; mildly alkaline (pH 7.6 BTB); clear smooth boundary.

C5 46-60" (117-152 cm) -- Reddish brown (5YR 5/4) loam, dark reddish brown (5YR 4/6) moist; massive, slightly hard to hard when dry, friable when moist, sticky and plastic when wet; common very fine and fine tubular pores; common fine pinkish white (5YR 8/2) lime and gypsum filaments; violently effervescent, mildly alkaline (pH 7.6 BTB).

Variations: Depths range to 60 inches or more except where buried lava flows limit depths. Small lava flow outcrops are included near the Little Colorado River. Alkalinity appears to be buffered by gypsum content.

Values of the surface soil are 5 and 6 dry, 3 and 4 moist; chromas are 2, 3, and 4 dry; 3, 4, and 6 moist. Textures of the surface soil are loam, sandy loam, and gravelly sandy loam. Structures of the surface soil are massive, weak coarse platy or single grain. Soils are stratified throughout and range in hue from 2.5YR to 5YR with values of 4 to 6 dry, 3 and 4 moist, and chromas of 3 to 6 dry, 4 and 6 moist. Textures of strata range from clay loam through loam and sandy loam. Structures of the strata are massive or occasionally weak medium subangular blocky.

4H - Cindery loam alluvium, 0 to 3 percent slopes

The 4H Cindery loam alluvium consists of well-drained soils. These are well-drained soils formed in alluvium from basalt, cinders and limestone in valley fills on fans. Elevation is 5100 to 5400 feet. Vegetation is composed of about 75 to 85 percent cover of black grama, galleta, needleandthread, rabbitbrush, with traces of spidergrass, mormon-tea, chamiza, bush muhly, Apacheplume, Russianthistle and oneseed juniper.

Typically, the surface layer is a dark brown gravelly loam or loam about 7 to 9 inches thick. The underlying layers are dark yellowish brown gravelly

loam or loam about 12 to 19 inches thick, grading to very gravelly loam or very gravelly sandy loam to 60 inches or more. The soil is weakly to violently effervescent. A discontinuous weakly cemented lime-silica pan may occur at depths between 24 to 42 inches. Alkalinity is usually moderate, but may become strongly alkaline in lower section.

The soil is moderately permeable. Effective rooting depth is about 36 to 42 inches. Runoff is medium. Erosion is slight.

These soils are used for range, wildlife, watershed, and park area.

Representative profile: West side, SE¼, Section 2, T25N, R8E, on east edge of borrow pit, Wupatki National Monument, Coconino County, Arizona.

A11 0-1" (0-2.5 cm) -- Brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; weak coarse platy structure; slightly hard when dry, very friable when moist; slightly sticky and slightly plastic when wet; plentiful very fine and fine, few medium roots; common very fine and fine vesicular, few very fine and fine interstitial pores; 15 to 20 percent very fine and fine black cinder gravel, weakly effervescent; moderately alkaline (pH 8.0 TB); abrupt smooth boundary.

A12 1-3" (2.5-8 cm) -- Brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak medium granular structure; slightly hard when dry, very friable when moist; slightly sticky and plastic when wet; plentiful very fine and fine, few medium roots; common very fine and fine interstitial and tubular, few medium tubular pores; 10 percent very fine, fine and medium black cinder gravel; weakly effervescent; moderately alkaline (pH 8.0 TB); clear smooth boundary.

A13 3-8" (8-20 cm) -- Brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; massive; hard when dry, friable when moist, sticky and plastic when wet; plentiful very fine and fine, few medium roots; 10 to 12 percent very fine, fine and medium black cinder gravel; weakly effervescent; moderately alkaline (pH 8.0 TB); clear wavy boundary.

C1 8-14" (20-36 cm) -- Light yellowish brown (10YR 6/4) gravelly loam, brown (7.5YR 4/4) moist; massive; hard when dry, friable when moist, sticky and plastic when wet; plentiful very fine and fine, few medium roots; common very fine and fine interstitial and tubular, few medium pores; 20 percent very fine, fine and medium black cinder gravel; effervescent; moderately alkaline (pH 8.2 TB); clear wavy boundary.

C2 14-27" (36-69 cm) -- Light brown (7.5YR 6/4) gravelly loam, brown (7.5YR 4/4) moist; massive; slightly hard when dry, friable when moist, slightly sticky and plastic when wet; plentiful very fine and fine, few medium roots; few very fine and fine interstitial and tubular pores; 30 percent very fine, fine, and medium black cinder gravel; strongly effervescent; strongly alkaline (pH 9.0 TB); clear wavy boundary.

C3 27-36" (69-91 cm) -- Light brown (7.5YR 6/4) very gravelly loam, brown (7.5YR 4/4) moist; massive; hard when dry, friable to brittle when moist, slightly sticky and slightly plastic when

wet; few very fine and fine roots; few very fine and fine interstitial and tubular pores; few fine white (7.5YR 8/0) lime filaments and soft masses; 40 percent very fine, fine and medium black cinder gravel partially lime coated; violently effervescent; strongly alkaline (pH 8.0 TB); clear wavy boundary.

C4 36-42" (91-107 cm) -- Light brown (7.5YR 6/4) very gravelly sandy loam, brown (7.5YR 4/4) moist; massive; very hard when dry, friable when moist, nonsticky and nonplastic when wet; few very fine and fine roots; few very fine interstitial and tubular pores; common fine white soft lime masses weakly cemented discontinuous lime-silica pans; 50 percent very fine, fine and medium black cinder gravel with lime coatings; violently effervescent; strongly alkaline (pH 8.8 TB); clear smooth boundary.

C5 42-60" (107-152 cm) -- Light brown (7.5YR 6/4) very gravelly sandy loam, brown (7.5YR 4/4) moist; massive; slightly hard when dry, very friable when moist, nonsticky and nonplastic when wet; few very fine roots; 50 percent very fine and fine black cinder gravel with lime coatings; strongly effervescent; strongly alkaline (pH 8.7 TB)

Variations: Depths to the discontinuous weakly cemented lime-silica pan varies from 24 to 42 inches. In many places this pan is absent entirely or there may be several layers of pan in places. Alkalinity (pH) is generally moderate, but may be strongly alkaline in lower part. Gravel (cinder) content varies from a trace to 60 percent in profile.

Values of the surface layer are 5 and 6 dry, 3 and 4 moist; chromas are 2 and 3 dry and moist. Surface textures are loam, gravelly loam and gravelly sandy loam. Surface soil structures are massive, weak coarse platy and moderate medium granular. Hues of the underlying strata are 7.5YR and 10YR; values are 5 and 6 dry, 3 and 4 moist; chromas are 2 to 4 dry; 3 and 4 moist. Textures are loam, gravelly loam and very gravelly loam. Structures are massive, weak medium subangular blocky and moderate medium subangular blocky.

5B - Rough broken land

This mapping unit consists of rough broken or hummocky mesas, hills, ledges and fans on the more shaly members of the Moenkopie formation. These areas are found largely on the east side of the Monument. Colors range in the reds, pinks, browns, grays and bluish grays. These shales are usually soft but are interbedded with thin strata of hard shales and sandstones. Some gypsum seams may also be present. Slopes range from 3 to 40 percent but may be steeper on ledges and scarps. Some alluvial soils are included in the narrow drainageways. Elevation ranges from 4400 to 4500 feet. Erosion is moderate to rapid. Runoff is rapid. Vegetation is composed of 20 to 40 percent cover consisting of shadscale, galleta, mormon-tea, chamiza, sand dropseed, rabbitbrush, broom snakeweed, with traces of fluffgrass, threeawn, Indian ricegrass, princesplume, and annual buckwheats. Present use of this land type is for very limited grazing or rangeland, wildlife, watershed and park area.

5C - Limestone canyons and scarps

This mapping unit consists of 60 to 70 percent limestone outcrop in the kaibab formation on very steep slopes of canyons and scarps, as part of the Doney Cliffs. Slopes range from 15 to 60 percent. The remainder consists of loam soils accumulated in cracks and crevices. The soils are similar to those described in the representative profile for Unit 3A, but may be shallower in many places and contains many fragments, angular and rounded cobbles and stones (30-35%) of limestone. Runoff is very rapid. Erosion is geologic. Vegetation consists mainly of black grama, needle-andthread, Texas bluestem, mormon-tea, chamiza, juniper, broom snakeweed, blue grama, paperdaisy, yucca and Apacheplume. Present use is very limited grazing by livestock where it can be traversed and for wildlife, watershed and park area.

5E - Sandstone and shale canyons and scarps

This unit is located in the very rugged, steep dissected areas of canyons and scarps in the Moenkopie formation. This mapping unit is made up larely of sandstone interbedded with shale. Colors mainly are reds, browns and tans. Included in the canyon floors are reddish brown loam soils from the sandstones and shales. Elevations are from 4300 to 4800 feet. Erosion is rapid and geologic. Runoff is rapid to very rapid. Vegetation is composed of 20 to 30 percent cover on the higher parts with about 40 percent in the canyon bottoms. Plants found in the unit are galleta, chamiza, alkali sacaton, rabbitbrush, mormon-tea, broom snakeweed, big sagebrush, sand sage, black grama, Indian ricegrass, Apacheplume, traces of princesplume, snakeweed, skunkbrush, sideoats grama, annual buckwheats, zinnia, and Russianthistle. Present use of this land type is for very limited grazing or range, wildlife, watershed, and park area.

RV Riverwash

This mapping unit consists of sand, gravels and cobble normally found in the active channels of washes and rivers. Slopes are nearly flat but may be hummocky. Very little vegetation is present except along the edges. Present use is very limited grazing, wildlife and watershed. It is subject to overflow following periods of rainfall.

ACREAGE OF SOIL MAPPING UNITS

WUPATKI NATIONAL MONUMENT
Coconino County, Arizona

Mapping Unit	Acreages
1A	3539
1B	1911
1E	221
1F	155
1H	215
1J	110
2A	711
2C	3224
2H	4206
2J	1396
3A	1043
3B	5702
3C	2271
3E	859
4E	1895
4F	447
4H	2009
5B	3314
5C	1541
5E	1604
RU	25
	36,398

RANGE SITE AND CONDITION INVENTORY

WUPATKI NATIONAL MONUMENT
Coconino County, Arizona

by

Jim W. Doughty, Range Conservationist

USDA, Soil Conservation Service

RANGE SITES AND RANGE CONDITION

Range sites are areas of rangeland that differ from each other in their ability to produce a certain kind or amount of vegetation in their original condition. Within the same general climate, differences in kind or amount of vegetation are due principally to variations in available soil moisture. These differences in vegetation, in turn, may be caused by any one or a combination of environmental factors, such as soil, precipitation, exposure, slope, or elevation. Likewise, differences in climate alone may result in different climax vegetation even though other factors remain the same.

Range Condition is an expression of how the present vegetative cover compares with the maximum cover which a range site is capable of producing.

Range plants can be divided into three general groups or classes based upon how they respond to grazing use and how they compete with each other. These groups are:

Decreasers: Normally these plants are most abundant on range in original (climax) condition. They tend to decrease under conditions of continual misuse, extended drought, repeated burning or other unfavorable conditions.

Increasers: These plants are always present, in varying amounts, in the original cover. They increase, at least temporarily, when the Decreaser plants are thinned out. Because these plants increase in the stand, they are called Increasers.

Invaders: Plants which normally do not grow on the site except in very small amounts. When conditions are so adverse that both the Decreaser plants and Increaser plants become thinned out and the plant cover is opened up, these plants invade the range site.

Present range condition is rated according to Range Condition classes. If the present cover is from 76 to 100 percent of the original cover for the site, it is called excellent condition; from 51 to 75 percent, it is good condition; 26 to 50 percent, fair condition; and if less than 25 percent, the range is classed as poor condition.

A knowledge of what the different range sites are capable of producing gives us a goal to work toward in forage improvement.

The range sites and range condition of these sites are shown on your map. A brief description of each of these sites and a guide to range condition follows. The letter "T" in the Percent Allowable column in the descriptions indicates that the particular plant should be present in quantities generally less than 5 percent.

CUa - CINDER UPLAND, 6 to 10 inches precipitation zone

The soils on this range site are very cindery loams that are well drained on sandstone interbedded with shales. When the soils are protected by plant cover, water intake rates and soil permeability is good. When denuded, wind and water erosion is very severe. This site is capable of producing 700 pounds of herbage per acre in favorable years and 300 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Indian ricegrass	Alkali sacaton	10	Russianthistle
Needleandthread	Galleta	35	Shadscale
Squirreltail	Blue grama	10	
Bush muhly	Dropseeds	T	
Sideoats grama	Threeawns	T	
Little bluestem	Fluffgrass	T	
Wolftail	Mormon-tea	5	
Black grama	Chamiza	10	
	Winterfat	5	
	Snakeweed	T	
	Sand sagebrush	5	
	Yucca	T	
	Squawbush	T	
	Perennial forbs	T	
	Native annuals	T	
	Apacheplume	5	
	Rabbitbrush	5	
	Brickellbush	5	

CUb - CINDER UPLAND, 10 to 16 inches precipitation zone

The soils on this range site are shallow, and medium textured with cinders on the surface and throughout the profile. These soils are moderately rapid to rapidly permeable. If unprotected by vegetation, the soil is highly susceptible to wind erosion. This site is capable of producing 1000 pounds of herbage per acre in favorable years and 450 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Sideoats grama	Blue grama	35	Oneseed juniper
Black grama	Galleta	20	Russianthistle
Needleandthread	Spike dropseed	T	
Wolftail	Sand dropseed	T	

Squirreltail	Chamiza	5
Vine-mesquite	Cacti	T
Spike muhly	Fringed sagebrush	T
	Woolly groundsel	T
	Winterfat	5
	Mormon-tea	T
	Yerbadepasmo baccharis	T
	Perennial forbs	T
	Native annuals	T
	Rabbitbrush	T

CUb(J) - CINDER UPLAND, 10 to 16 inches precipitation zone, Juniper

The soils on this range site are moderately deep over basalt. These soils are moderately permeable. If unprotected by vegetative cover, the soil is highly susceptible to wind erosion. This site is capable of producing 1000 pounds of herbage per acre in favorable years and 600 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Black grama	Blue grama	30	Russianthistle
Squirreltail	Threeawns	T	
Indian ricegrass	Dropseeds	5	
Needleandthread	Galleta	5	
Littleseed ricegrass	Alkali sacaton	T	
	Rubber rabbitbrush	T	
	Snakeweed	T	
	Chamiza	5	
	Winterfat	5	
	Big sagebrush	T	
	Cacti	T	
	Yucca	T	
	Oneseed or Utah juniper	10	
	Pinyon	5	
	Perennial forbs	T	
	Native annuals	T	

LBb - LOAM BOTTOMS, 10 to 16 inches precipitation zone

The soils on this range site are medium textured alluvial soils from mixed parent material. Good permeability when the soils are protected by good plant cover; when denuded, the soils are very susceptible to water and wind erosion. These soils get extra water from runoff in the summer rainy season. This site is capable of producing 1100 pounds of herbage per acre in favorable years and 700 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Western wheatgrass	Blue grama	35	Russianthistle
Spike muhly	Alkali sacaton	25	Oneseed juniper
Sideoats grama	Dropseeds	T	
Vine-mesquite	Ring muhly	T	
Little bluestem	Cacti	T	
	Snakeweed	T	
	Rabbitbrush	T	
	Fringed sagebrush	T	
	Chamiza	15	
	Winterfat	5	
	Apacheplume	T	
	Horsebrush	T	
	Perennial forbs	T	
	Native annuals	T	

LFa - LOAM FANS, 6 to 10 inches precipitation zone

The soils on this range site are moderately deep alluviums from mixed parent material. These soils take water rapidly when protected by good plant cover. They are very susceptible to wind and water erosion when plant cover is depleted. This site is capable of producing 400 pounds of herbage per acre in favorable years and 300 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Black grama	Galleta	25	Russianthistle
Indian ricegrass	Dropseeds	5	
New Mexico feathergrass	Alkali sacaton	25	
Sideoats grama	Threeawns	T	
Bush muhly	Bigelow or black sage	T	
Blue grama	Mormon-tea	T	
Squirreltail	Shadscale	T	
	Shrubby buckwheats	T	
	Snakeweed	T	
	Cacti	T	
	Chamiza	5	
	Rubber rabbitbrush	T	
	Winterfat	5	
	Perennial forbs	T	
	Native annuals	T	

LUa - LOAMY UPLAND, 6 to 10 inches precipitation zone

The soils on this range site have a medium textured surface underlain by clay loams. These are moderately deep soils with good water intake and water-holding capacity as long as they are protected by a good vegetative

cover. This site is capable of producing 600 pounds of herbage per acre in favorable years and 300 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Indian ricegrass	Galleta	35	Russianthistle
Blue grama	Threeawns	5	Spiny muhly
Needleandthread	Alkali sacaton	5	
Squirreltail	Sand dropseed	5	
	Spike dropseed	T	
	Ring muhly	T	
	Mormon-tea	5	
	Chamiza	5	
	Snakeweed	T	
	Winterfat	5	
	Sand sagebrush	T	
	Perennial forbs	T	
	Native annuals	T	

LUb - LOAMY UPLAND, 10 to 16 inches precipitation zone

The soils on this range site are medium textured on the surface underlain by clay loams. These are moderately deep soils with good water intake and water-holding capacity as long as they are protected by a good vegetative cover. This site is capable of producing 750 pounds of herbage per acre in favorable years and 500 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Wolftail	Blue grama and		Utah juniper
Squirreltail	hairy grama	40	Oneseed juniper
Black grama	Threeawns	5	Russianthistle
Needleandthread	Galleta	10	Spiny muhly
Sideoats grama	Sand dropseed and		
Indian ricegrass	mesa dropseed	5	
Mutton bluegrass	Spike dropseed	T	
	Ring muhly	T	
	Alkali sacaton	T	
	Cacti	T	
	Chamiza	5	
	Horsebrush	T	
	Woolly groundsel	T	
	Snakeweed	T	
	Rabbitbrush	T	
	Winterfat	5	
	Fringed sagebrush	T	
	Yucca	T	

	Algerita	T
	Mormon-tea	T
	Sand sagebrush	T
	Perennial forbs	5
	Native annuals	T

LUb(J) - LOAMY UPLAND, 10 to 16 inches precipitation zone, Juniper

This range site has medium textured, often gravelly surface soils with clay loam subsoils. The soils are moderately deep with good permeability and water intake capacity when protected by good vegetative cover. This site is capable of producing 700 pounds of herbage per acre in favorable years and 600 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Black grama	Blue grama	30	Spiny muhly
Squirreltail	Threeawns	T	Russianthistle
Indian ricegrass	Dropseed	5	
Needleandthread	Galleta	5	
Littleseed ricegrass	Alkali sacaton	T	
	Rubber rabbitbrush	T	
	Snakeweed	T	
	Chamiza	5	
	Winterfat	5	
	Sand sagebrush and big sagebrush	T	
	Cacti	T	
	Yucca	T	
	Oneseed or Utah juniper	10	
	Pinyon	5	
	Perennial forbs	T	
	Native annuals	T	

SAa - SAND UPLAND, 6 to 10 inches precipitation zone

The soil on this range site is a very gravelly fine cindery loam which affects the vegetation much the way sand does. The soil is moderately rapid to rapidly permeable. When plant cover is depleted, the soils are very susceptible to severe erosion by wind and water. This site is capable of producing 600 pounds of herbage per acre in favorable years and 500 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Black grama	Galleta	30	Russianthistle
Indian ricegrass	Dropseeds	10	
Blue grama	Spiny muhly	T	
Needleandthread	Alkali sacaton	5	
Squirreltail	Threeawns	T	
Sand bluestem	Mormon-tea	5	
	Rabbitbrush	5	
	Sand sagebrush	5	
	Snakeweed	T	
	Winterfat	5	
	Chamiza	5	
	Cacti	T	
	Perennial forbs	T	
	Native annuals	T	

SHBa - SHALLOW UPLAND, BASALT, 6 to 10 inches precipitation zone

The soil on this range site is shallow to basalt with no development. These soils have good permeability and water intake rates when protected by vegetative cover. These soils are highly susceptible to wind erosion. This site is capable of producing 600 pounds of herbage per acre in favorable years and 450 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Black grama	Galletta	25	Russianthistle
Sideoats grama	Threeawns	T	
Needleandthread	Dropseeds	5	
Blue grama	Alkali sacaton	30	
Squirreltail	Cacti	T	
Indian ricegrass	Snakeweed	T	
Menodora	Winterfat	5	
New Mexico feather-grass	Chamiza	20	
	Rabbitbrush	T	
Bush muhly	Shrubby buckwheats	T	
	Bigelow sagebrush	5	
	Mormon-tea	5	
	Woolly groundsel	T	
	Shadscale	T	
	Perennial forbs	T	
	Native annuals	T	

SHBb - SHALLOW UPLAND, BASALT, 10 to 16 inches precipitation zone

The soils on this range site are very shallow, 6-10 inches, over basalt. They are moderately permeable and when unprotected by vegetation, they are highly susceptible to wind erosion. This site is capable of producing 800

pounds of herbage per acre in favorable years and 450 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Black grama	Blue grama	40	Russianthistle
Needleandthread	Dropseeds	5	Oneseed juniper
Indian ricegrass	Galleta	15	Utah juniper
Sideoats grama	Threeawns	T	Pinyon
Squirreltail	Alkali sacaton	T	
Desert needlegrass	Ring muhly	T	
	Bigelow sagebrush	T	
	Chamiza	10	
	Winterfat	10	
	Mormon-tea	5	
	Snakeweed	T	
	Shrubby buckwheats	T	
	Horsebrush	T	
	Rabbitbrush	T	
	Woolly groundsel	T	
	Cliffrose	T	
	Apacheplume	T	
	Perennial forbs	T	
	Native annuals	T	

SHBb(J) - SHALLOW UPLAND, BASALT, 10 to 16 inches precipitation zone, Juniper

The soils on this range site are very shallow, 6 to 10 inches, over basalt. They are moderately permeable and when unprotected by vegetation, they are highly susceptible to wind erosion. This site is capable or producing 950 pounds of herbage per acre in favorable years and 600 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Needleandthread	Blue grama	35	Russianthistle
Indian ricegrass	Dropseeds	T	
Littleseed ricegrass	Galleta	5	
Squirreltail	Threeawns	T	
Sideoats grama	Alkali sacaton	5	
Black grama	Ring muhly	T	
New Mexico feather-grass	Algerita	T	
	Snakeweed	T	
	Cacti	T	
	Cliffrose	T	
	Horsebrush	T	

Apacheplume	T
Mormon-tea	T
Shrubby buckwheats	T
Bigelow sagebrush	T
Fringed sagebrush	T
Rabbitbrush	T
Winterfat	5
Chamiza	5
Oneseed juniper	5
Perennial forbs	T
Native annuals	T

SHLa - SHALLOW UPLAND, LIMESTONE, 6 to 10 inches precipitation zone

The soil on this range site is shallow to limestone with no development. These soils have good permeability and water intake rates when protected by vegetative cover. These soils are highly susceptible to wind erosion. This site is capable of producing 600 pounds of herbage per acre in favorable years and 450 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Black grama	Galleta	25	Russianthistle
Sideoats grama	Threeawns	T	
Needleandthread	Dropseeds	5	
Blue grama	Alkali sacaton	30	
Squirreltail	Cacti	T	
Indian ricegrass	Snakeweed	T	
Menodora	Winterfat	5	
New Mexico feathergrass	Chamiza	20	
	Rabbitbrush	T	
Bush muhly	Shrubby buckwheats	T	
	Bigelow sagebrush	5	
	Mormon-tea	5	
	Woolly groundsel	T	
	Shadscale	T	
	Perennial forbs	T	
	Native annuals	T	

SHLa(J) - SHALLOW UPLAND, LIMESTONE, 10 to 16 inches precipitation zone, Juniper

The soil on this range site is shallow and medium textured to limestone with no development. Water intake and soil permeability are good when soils are protected by good vegetative cover. These soils are very susceptible to wind erosion. This site is capable of producing 950 pounds of herbage per acre in favorable years and 600 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Needleandthread	Blue grama	25	Russianthistle
Indian ricegrass	Alkali sacaton	15	
Squirreltail	Sand dropseed	T	
Sideoats grama	Galleta	5	
Black grama	Threeawns	T	
New Mexico feather-grass	Ring muhly	T	
	Snakeweed	T	
Menodora	Cacti	T	
	Apacheplume	T	
	New Mexican forestiera	T	
	Mormon-tea	T	
	Shrubby buckwheats	T	
	Bigelow sagebrush	T	
	Fringed sagewort	T	
	Rabbitbrush	5	
	Winterfat	5	
	Chamiza	5	
	Oneseed juniper	5	
	Pinyon	5	
	Perennial forbs	T	
	Native annuals		

SHSa - SHALLOW UPLAND, SANDSTONE, 6 to 10 inches precipitation zone

The soil on this range site is shallow to sandstone with no development. These soils have good permeability and water intake rates when protected by vegetative cover. These soils are highly susceptible to erosion. This site is capable of producing 600 pounds of herbage per acre in favorable years and 450 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Black grama	Galleta	25	Russianthistle
Sideoats grama	Threeawns	T	
Needleandthread	Dropseeds	5	
Blue grama	Alkali sacaton	25	
Squirreltail	Cacti	T	
Indian ricegrass	Snakeweed	T	
Menodora	Winterfat	5	
New Mexico feather-grass	Chamiza	20	
	Rabbitbrush	T	
Bush muhly	Shrubby buckwheats	T	
	Bigelow sagebrush	5	
	Mormon-tea	5	
	Woolly groundsel	T	
	Shadscale	T	
	Perennial forbs	T	
	Native annuals	T	

SHSb - SHALLOW UPLAND, SANDSTONE, 10 to 16 inches precipitation zone

The soils on this range site are very shallow, 6 to 10 inches, over sandstone. They are moderately permeable and when unprotected by vegetation, they are highly susceptible to wind erosion. This site is capable of producing 800 pounds of herbage per acre in favorable years and 450 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Black grama	Blue grama	40	Russianthistle
Needleandthread	Dropseeds	5	Oneseed juniper
Indian ricegrass	Galleta	15	Utah juniper
Sideoats grama	Threeawns	T	Pinyon
Squirreltail	Alkali sacaton	5	
Desert needlegrass	Ring muhly	T	
	Bigelow sagebrush	T	
	Chamiza	10	
	Winterfat	10	
	Mormon-tea	5	
	Snakeweed	T	
	Shrubby buckwheats	T	
	Horsebrush	T	
	Rabbitbrush	T	
	Woolly groundsel	T	
	Cliffrose	T	
	Apacheplume	T	
	Perennial forbs	T	
	Native annuals	T	

SHSb(J) - SHALLOW UPLAND, SANDSTONE, 10 to 16 inches precipitation zone, Juniper

The soil on this range site is shallow and medium textured to sandstone with no development. Water intake and soil permeability are good when soils are protected by good vegetative cover. These soils are very susceptible to wind erosion. This site is capable of producing 950 pounds of herbage per acre in favorable years and 600 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Needleandthread	Blue grama	35	Russianthistle
Indian ricegrass	Sand dropseed	T	
Littleseed ricegrass	Galleta	5	
Squirreltail	Threeawns	T	
Wolftail	Ring muhly	T	
Sideoats grama	Algerita	T	

Mutton bluegrass	Snakeweed	T
Spike muhly	Cacti	T
New Mexico muhly	Cliffrose	T
Black grama	Horsebrush	T
Junegrass	Apacheplume	T
New Mexico feather-grass	Fernbush	T
	New Mexican forestiera	T
Menodora	Mormon-tea	T
	Shrubby buckwheats	T
	Bigelow sagebrush	T
	Fringed sagewort	T
	Rabbitbrush	T
	Winterfat	5
	Chamiza	5
	Oneseed juniper	5
	Pinyon	5
	Perennial forbs	T
	Native annuals	T

SUa - SHALE UPLAND, 6 to 12 inches precipitation zone

The soils on this site are shallow, medium textured and formed in place from Moenkopie shale, mudstone and sandstone. The soils vary in depth to parent material from 6 inches to 18 inches but no significant difference is apparent in yield or plan composition. These soils have a mantle of fine sandy loam soil on the surface and the underlying parent material is fractured and fissured. When the soils are protected by plant cover, water intake rate and permeability is good. When denuded, wind and water erosion is severe. This site is capable of producing 650 pounds of herbage per acre in favorable years and 300 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Indian ricegrass	Alkali sacaton	10	Rabbitbrush
Needleandthread	Galleta	35	Russianthistle
Blue grama	Dropseeds	T	Shadscale
Squirreltail	Threeawns	T	
Bush muhly	Fluffgrass	T	
Sideoats grama	Mormon-tea	5	
Little bluestem	Chamiza	10	
Wolftail	Winterfat	5	
Black grama	Snakeweed	T	
	Bigelow or black sagebrush	5	
	Yucca	T	
	Squawbush	T	
	Wolfberry	T	
	Perennial forbs	T	
	Native annuals	T	

VSLa - VERY SHALLOW, LIMESTONE, 6 to 10 inches precipitation zone

This range site consists of a gravelly loam soil that is medium textured and shallow to limestone. About 30 percent of the site is limestone rock outcrops. When the soil is protected by vegetative cover, water intake and soil permeability are good. These soils are very susceptible to severe erosion when not protected by vegetative cover. This site is capable of producing 650 pounds of herbage per acre in favorable years and 300 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Indian ricegrass	Alkali sacaton	25	Russianthistle
Needleandthread	Galleta	25	
Blue grama	Dropseeds	T	
Squirreltail	Threeawns	T	
Bush muhly	Fluffgrass	T	
Sideoats grama	Mormon-tea	5	
Little bluestem	Chamiza	10	
Wolftail	Winterfat	5	
Black grama	Snakeweed	T	
	Sand sagebrush	5	
	Yucca	T	
	Squawbush	T	
	Wolfberry	T	
	Perennial forbs	T	
	Native annuals	T	
	Apacheplume	T	
	Brickellbush	T	
	Rabbitbrush	5	

VSLb(J) - VERY SHALLOW, LIMESTONE, 10 to 16 inches precipitation zone, Juniper

This range site consists of a gravelly loam soil that is medium textured and very shallow to limestone. About 30 percent of the site is limestone rock outcrops. When the soil is protected by vegetative cover, water intake and soil permeability are good. These soils are very susceptible to severe erosion when not protected by vegetative cover. This site is capable of producing 700 pounds of herbage per acre in favorable years and 500 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Needleandthread	Blue grama	35	Russianthistle
Indian ricegrass	Alkali sacaton	10	
Squirreltail	Sand dropseed	T	
Wolftail	Galleta	5	
Sideoats grama	Threeawns	T	
Spike muhly	Ring muhly	T	
Black grama	Snakeweed	T	
New Mexico feather-grass	Cacti	T	
	Cliffrose	T	
Menodora	Apacheplume	T	
	New Mexican forestiera	T	
	Mormon-tea	T	
	Shrubby buckwheats	T	
	Bigelow sagebrush	T	
	Rabbitbrush	5	
	Winterfat	5	
	Chamiza	5	
	Oneseed juniper	5	
	Pinyon	5	
	Perennial forbs	T	
	Native annuals	T	

VSSa - VERY SHALLOW, SANDSTONE, 6 to 10 inches precipitation zone

The soils on this range site are very shallow, medium textured with 25 to 40 percent rock outcrops. Fans, slopes and drainageways have a thin mantle of gravelly loam soil. When the soils are protected by vegetative cover, water intake and permeability is good. These soils are very susceptible to severe erosion. This site is capable of producing 650 pounds of herbage per acre in favorable years and 300 pounds in unfavorable years.

This site is capable of producing the following vegetative species:

Decreasers (count all)	Increasers	Percent Allowable	Invaders (count none)
Indian ricegrass	Alkali sacaton	10	Rabbitbrush
Needleandthread	Galleta	35	Russianthistle
Blue grama	Dropseeds	T	Shadscale
Squirreltail	Threeawns	T	
Bush muhly	Fluffgrass	T	
Sideoats grama	Mormon-tea	5	
Little bluestem	Chamiza	10	
Wolftail	Winterfat	5	
Black grama	Snakeweed	T	
	Sand sagebrush	5	
	Yucca	T	
	Squawbush	T	
	Wolfberry	T	
	Perennial forbs	T	
	Native annuals	T	
	Apache plume	T	
	Brickellbush	T	

CONVENTIONAL SIGNS

ghways and roads

- Good motor road
- Poor motor road
- Trail
- U. S. Highway

ldings

- Headquarters or residential
- Indian ruins
- Utility areas — Labeled

er transmission line

bage dump

vel pit

w hole

ument boundary (approximate)

tion corners, recovered — 15|14

inage

- Intermittent stream, small
- large
- ending in alluvial fan

rock escarpment

k

l survey data

- Soil boundary and symbol — 4H
- Small areas of bedrock outcrop
- Small areas of gravel or cobble

SOILS OF THE
WUPATKI NATIONAL MONUMENT
Coconino County, Arizona

SOILS DERIVED FROM VOLCANICS

1A Gravelly loam, moderately deep over basalt, 0-5% slopes.
1B Stony loam, shallow over basalt, 5-15% slopes.
1E Cinder slopes.
1F Very coarse loamy sand on cinder cones, 8-40% slopes.
1H Very gravelly cindery loam, 3-5% slopes.
1J Very gravelly loam on pumice, 3-8% slopes.

SOILS DERIVED FROM SANDSTONE

2A Cindery loam, very shallow on sandstone, 0-5% slopes.
2C Very shallow gravelly loam-Sandstone outcrop complex, 3-30% slopes.
2H Very cindery loam-Sandstone outcrop complex, 0-30% slopes.
2J Very cindery loam, very shallow on sandstone, 0-5% slopes.

SOILS DERIVED FROM LIMESTONE

3A Gravelly loam, shallow on limestone, 0-3% slopes.
3B Cravelly loam-Limestone outcrop complex, 0-3% slopes.
3C Cindery loam-Limestone outcrop complex, 0-3% slopes.
3E Cravelly loam-Limestone outcrop complex, 3-15% slopes.

ALLUVIAL SOILS

4E Gravelly loam alluvium, 0-3% slopes.
4F Loam alluvium, 0-3% slopes.
4H Cindery loam alluvium, 0-3% slopes.

MISCELLANEOUS

5B Rough broken land.
5C Limestone canyons and scarps.
5E Sandstone and shale canyons and scarps.
RV Riverwash.

This map is intended for general planning. Each delineation may contain soils different from those shown on the map. Use on site inspection for more detailed decisions.

CONVENTIONAL SIGNS

Highways and roads

- Good motor road
- Poor motor road
- Trail
- U. S. Highway (89)

Buildings

- Headquarters or residential
- Indian ruins
- Utility areas (Labeled)

Power transmission line

Garbage dump

Cravel pit

Blow hole

Monument boundary (approximate)

Section corners, recovered (15|14)

Drainage

- Intermittent stream, small
- large
- ending in alluvial fan

Bedrock escarpment

Sink

Soil survey data

- Soil boundary and symbol (4H)
- Small areas of bedrock outcrop
- Small areas of gravel or cobble

RANGE SITE LEGEND

The first two capital letters are from the range site name. The third capital letter, when used, denotes parent material. The small letter denotes precipitation zone (a - 6 to 10 inches p.z., b - 10 to 16 inches p.z.). (J) denotes a juniper range site.

CUa	Cinder Upland, 6 to 10 inches p.z.
CUb	Cinder Upland, 10 to 16 inches p.z.
CUb(J)	Cinder Upland, 10 to 16 inches p.z., Juniper
LBb	Loam Bottoms, 10 to 16 inches p.z.
LFa	Loam Fans, 6 to 10 inches p.z.
LUa	Loamy Upland, 6 to 10 inches p.z.
LUb	Loamy Upland, 10 to 16 inches p.z.
LUb(J)	Loamy Upland, 10 to 16 inches p.z., Juniper
SAa	Sand Upland, 6 to 10 inches p.z.
SHBa	Shallow Upland, Basalt, 6 to 10 inches p.z.
SHBb	Shallow Upland, Basalt, 10 to 16 inches p.z.
SHBb(J)	Shallow Upland, Basalt, 10 to 16 inches p.z., Juniper
SHLa	Shallow Upland, Limestone, 6 to 10 inches p.z.
SHLa(J)	Shallow Upland, Limestone, 6 to 10 inches p.z., Juniper
SHSa	Shallow Upland, Sandstone, 6 to 10 inches p.z.
SHSb	Shallow Upland, Sandstone, 10 to 16 inches p.z.
SHSb(J)	Shallow Upland, Sandstone, 10 to 16 inches p.z.,Juniper
SUa	Shale Upland, 6 to 10 inches, p.z.
VSLa	Very Shallow, Limestone, 6 to 10 inches p.z.
VSLb(J)	Very Shallow, Limestone, 10 to 16 inches p.z., Juniper
VSSa	Very Shallow, Sandstone, 6 to 10 inches p.z.

Range Site and Condition

Site boundary and symbol — SHBb

Condition boundary and symbol — G

RANGE CONDITION

E = Excellent - 76 to 100 percent of original cover
G = Good - 51 to 75 percent of original cover
F = Fair - 26 to 50 percent of original cover
P = Poor - Less than 25 percent of original cover

INDEX TO MAP SHEETS

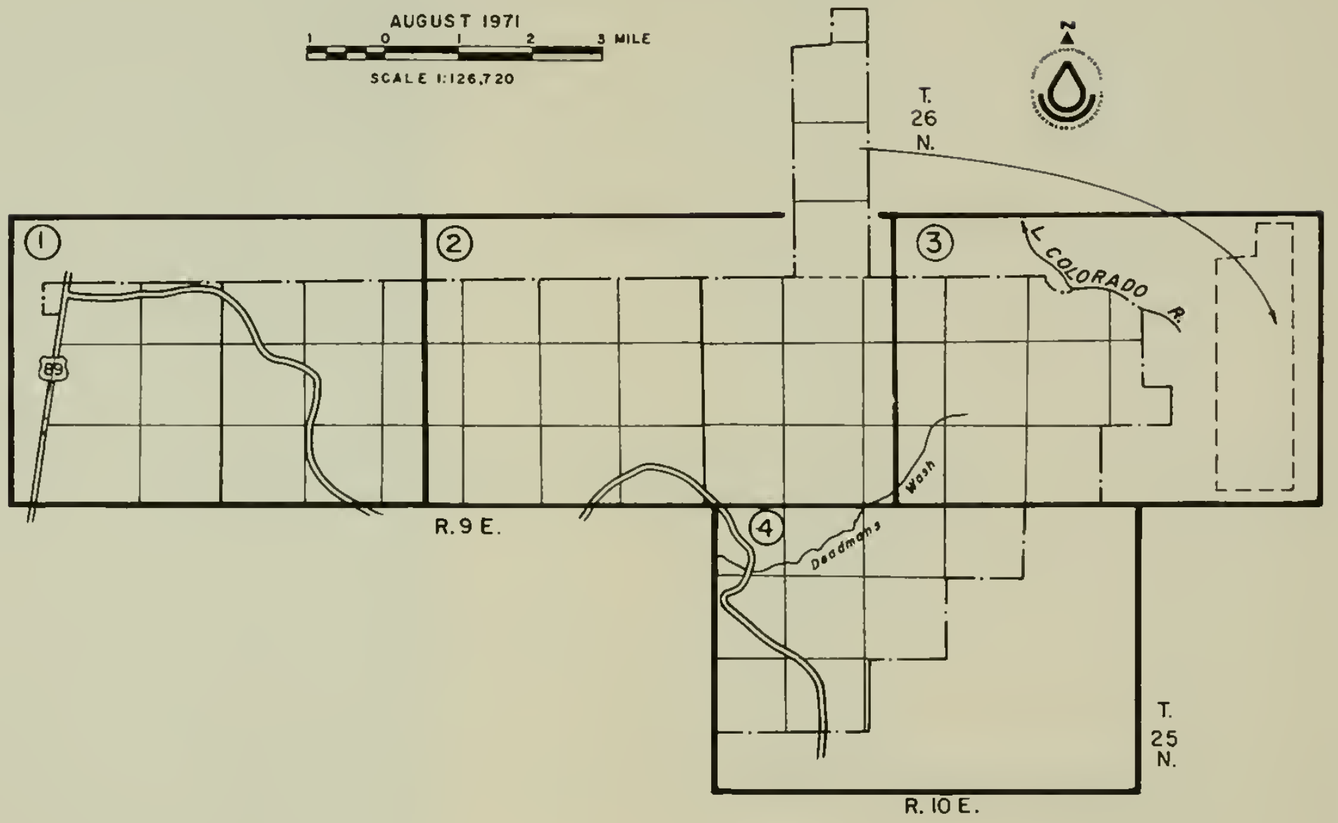
WUPATKI NATIONAL MONUMENT SOIL SURVEY AREA

ARIZONA

AUGUST 1971

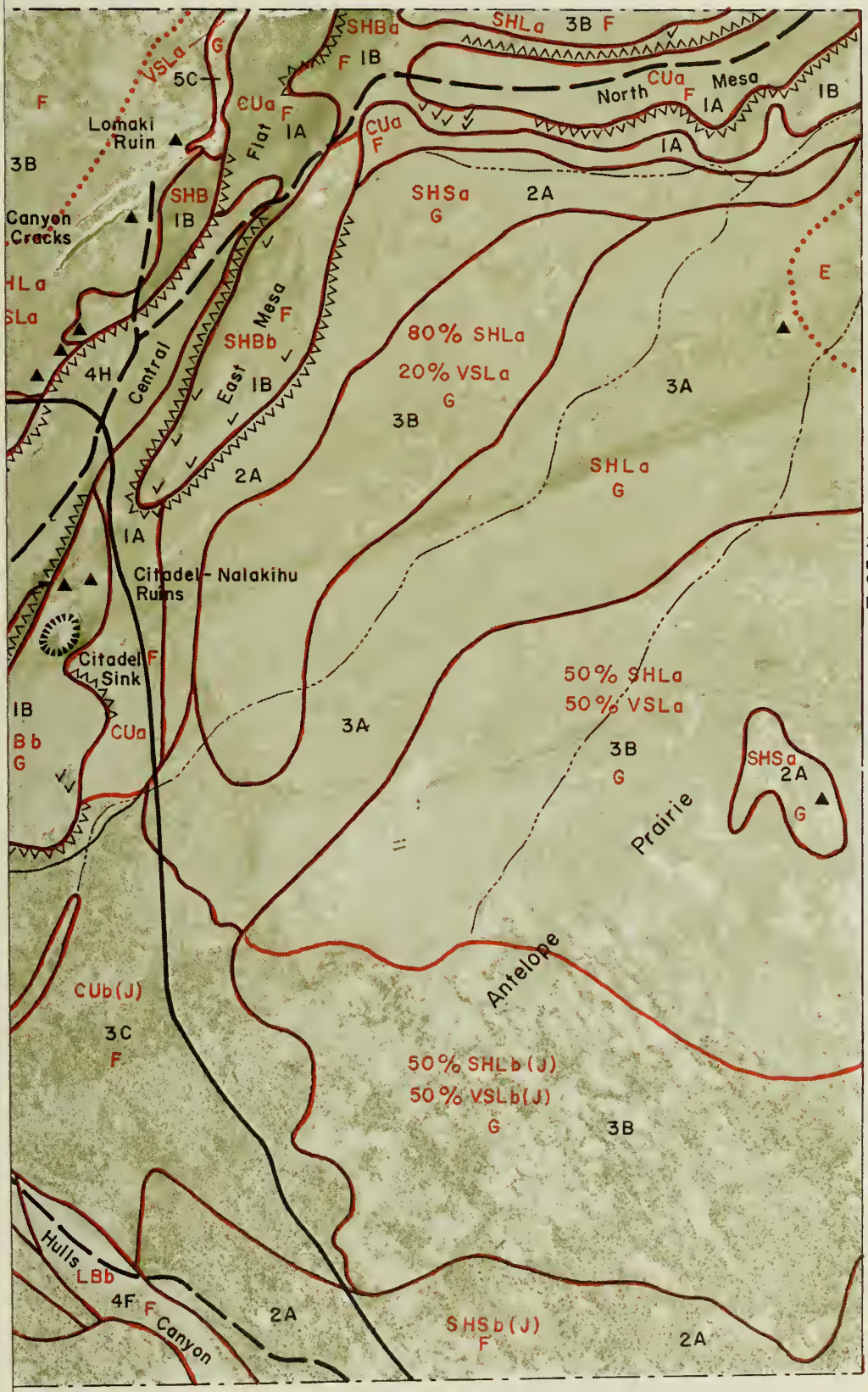
1 0 1 2 3 MILE

SCALE 1:126,720



U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE
U. S. DEPARTMENT OF INTERIOR, NATIONAL PARK SERVICE

This map is one of a set compiled in 1971 as part of a Soil Survey by the United States Department of Agriculture, Soil Conservation Service, and the Department of Interior, National Park Service. Land division corners are approximately positioned on this map.



WUPATKI NATIONAL MONUMENT ARIZONA- SHEET NUMBER 1

(1)

R.8E. | R.9E.

T. 25 N.

(Joins sheet 2)

Blow Hole

Middle Mesa

Lomaki Ruin

Box Canyon Earth Cracks

Cedar Canyon

Central Mesa

East Mesa

North Mesa

Flat

Citadel-Nalakihu Ruins

Citadel Sink

South Mesa

West Mesa

Prairie

Antelope

Hulls Canyon

Antelope Hills

MONUMENT BOUNDARY

LIMIT OF NATIONAL MONUMENT SURVEY

70% SHLa
30% VSLa
E 3B

80% SHLa
20% VSLa
G

80% SHLa
20% VSLa
G
3B

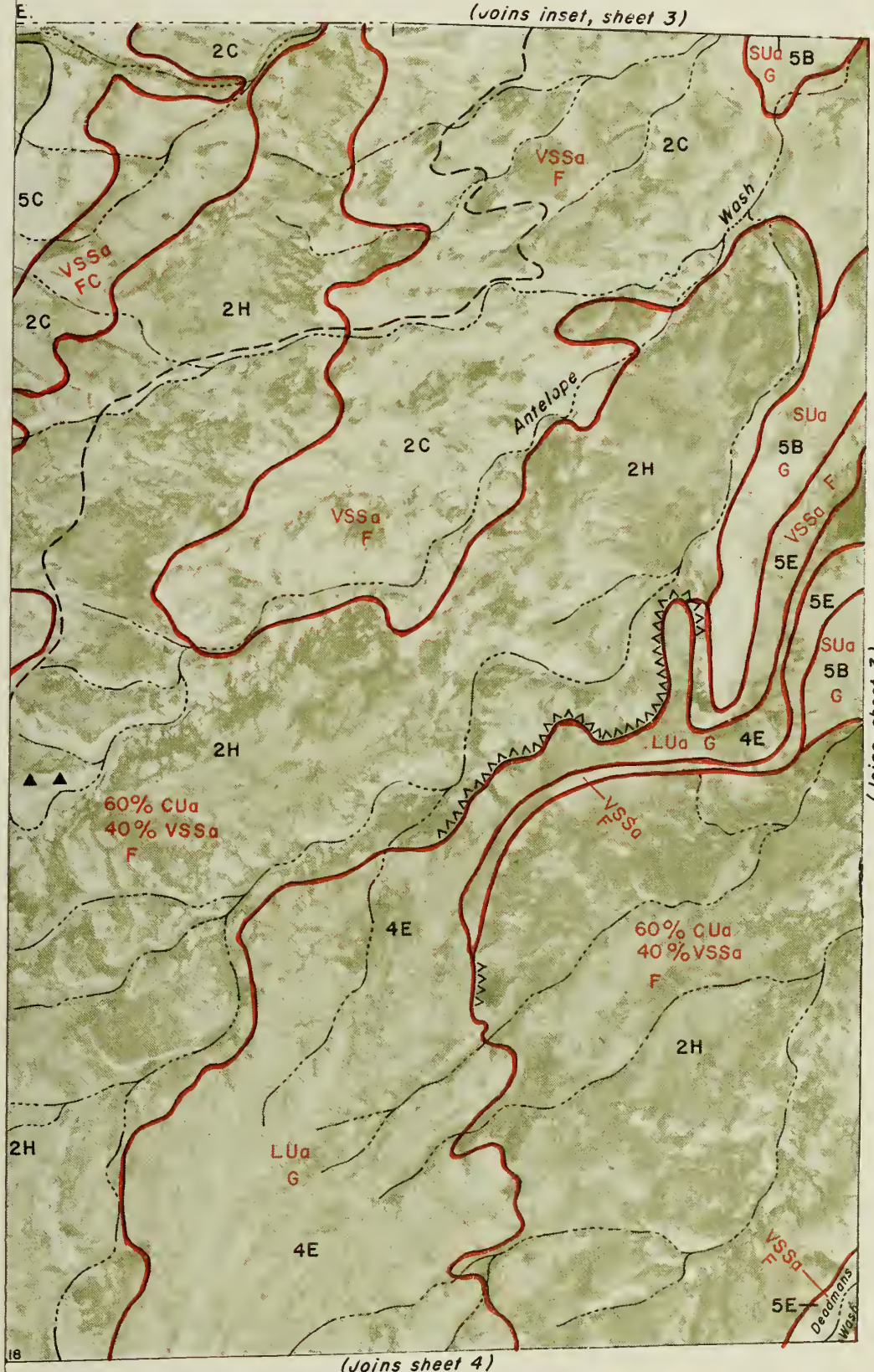
50% SHLa
50% VSLa
3B
G

50% SHLb(J)
50% VSLb(J)
G
3B

1 Mile
5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:24000

This map is one of a set compiled in 1971 as part of a Soil Survey by the United States Department of Agriculture, Soil Conservation Service, and the Department of Interior, National Park Service. Land division corners are approximately positioned on this map.



1 Mile

5000 Feet

WUPATKI NATIONAL MONUMENT, ARIZONA – SHEET NUMBER 2

(2)

R.9 E. | R.10 E.

(Joins inset, sheet 3)

T. 25 N.

(Joins sheet 1)

(Joins sheet 3)

(Joins sheet 4)

Citadel Wash

Prairie

Antelope

Doney Cliffs

Antelope Wash

Doney Crater

Antelope Ruin

50 % SHLo
50 % VSLo
G

60% CUo
40% VSSo
F

40 % SHLo
60 % VSLo
G

50% SHLb(J)
50% VSLb(J)
G

30%SHLb(J)
70%VSLb(J)
F

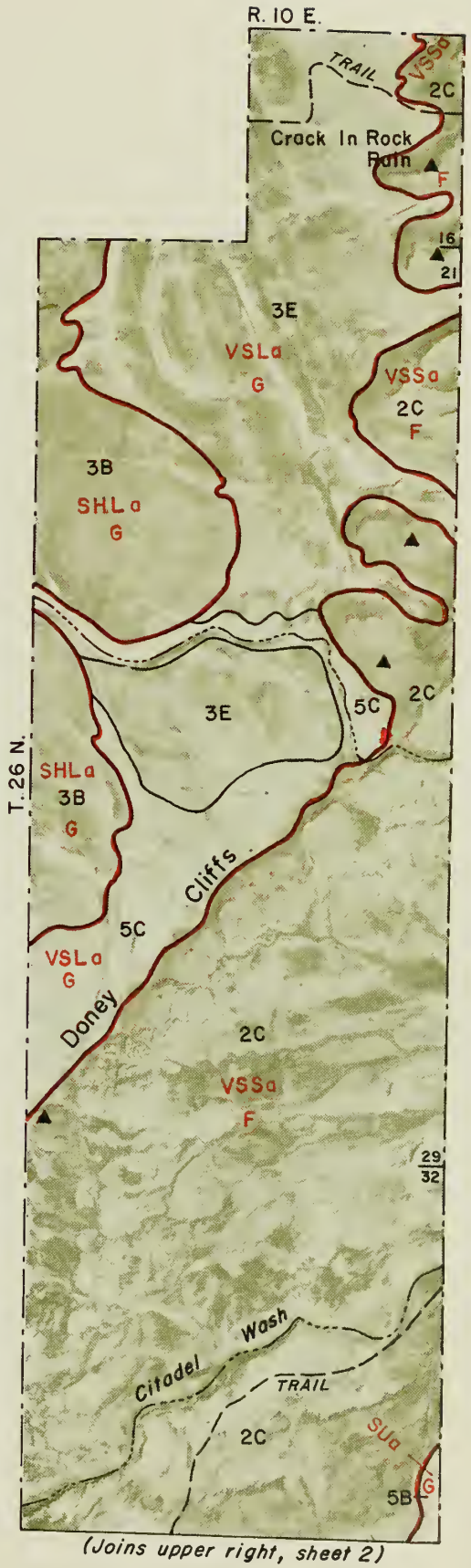
1 ½ ½ ½ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:24000

Land division corners are approximately positioned on this map
and the Department of Interior, National Park Service

This map is one of a set compiled in 1971 as part of a Soil Survey by the United States Department of Agriculture, Soil Conservation Service, and the Department of Interior, National Park Service. Land division corners are approximately positioned on this map



1 Mile

5000 Feet

This map is one of a set compiled in 1971 as part of a Soil Survey by the United States Department of Agriculture, Soil Conservation Service, and the Department of Interior, National Park Service. Land division corners are approximately positioned on this map

R. 10 E.

T. 25 N.

T. 26 N.

LITTLE COLORADO RIVER

Wash

Kana-a Wash

Deadmans Wash

Doney Cliffs

Citadel Wash

TRAIL

Crack In Rock Path

RV

LFa 4F P

2C VSSa F

5B

SUa G

4E LUa F

VSSa 5E

4E LUa G F

4F

LFa P

SUa 5B F

5E

2C

VSSa F

2H 60 % CUa 40 % VSSa F

LUa 4E F

SHBa F

1B

CUa G

2J

15|14

3E VSLa G

VSSa 2C F

3B SHLa G

5C

VSLa G

29/32

(Joins sheet 2)

(Joins sheet 4)

(Joins upper right, sheet 2)

1 ½ ½ 0 1 Mile

5000 4000 3000 2000 1000 0 5000 Feet

Scale 1:24000

MBER 4

This map is one of a set compiled in 1971 as part of a Soil Survey by the United States Department of Agriculture, Soil Conservation Service, and the Department of Interior, National Park Service. Land division corners are approximately positioned on this map.

1 Mile

5000 Feet

WUPATKI NATIONAL MONUMENT, ARIZONA - SHEET NUMBER 4